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Scientific and Technical Documentation—and Co-operation in this field
M. DUCAS

The Effect of Membership of the Common Market on Information Work
GÜNTHER REICHARDT

Before the Machines come
D. J. SIMPSON

A Computer-assisted, Flexible Information Retrieval System
T. N. SHAW

Selective Dissemination of Information using a KDF9 Computer
L. J. ANTHONY, D. H. CARPENTER *and* A. G. CHENEY

Search Strategy Evaluation in Manual and Automated Systems
MICHAEL KEEN

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ASLIB PROCEEDINGS

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ASLIB CALENDAR 1968

January

FRI.5.	Engineering Group. One-day conference on bio-medical engineering.
MON.8 – FRI.12.	Course on Co-ordinate Indexing.
TUE.9.	Chemical Group meeting: 'How good is the Kent Service?' by Dr A. Kent.
TUE.23.	Evening meeting. 'The proposed World Institute for Documentation of Housing, Building and Planning.'

February

TUE.20.	Evening meeting. 'Many questions,' by Mrs E. Mack.
TUE.27–WED.28.	Courses on work with patents.

March

THU.21.	Afternoon meeting at Aslib. 3 p.m. 'The computer: what it is and what it can do,' by Miss A. Chilton, Senior Lecturer, Birmingham College of Commerce.
FRI.29.	Scottish Branch—Annual General Meeting and one-day conference.

April

TUE.23.	Second Aslib Annual Lecture, by Sir Frank Francis.

Second Aslib Annual Lecture

Sir Frank Francis, Director and Principal Librarian of the British Museum, will deliver the second Aslib Annual Lecture on the evening of Tuesday 23rd April 1968. It will take place in the William Beveridge Hall at the Senate House of the University of London. The title will be 'The two cultures in information work'. Admission will be by ticket only.

New Scientific and Technical Books

The Publishers Association has supplied Aslib with copies of a catalogue of books published since 1966, which were on display at the Aslib Annual Conference, 9th to 12th October at Harrogate. Copies may be obtained, free of charge, from the Publications Department, Aslib.

'Facts and how to find them'

On Wednesday 6th December 1967 Aslib members heard a lively and entertaining talk by the McWhirter twins, Norris and Ross. It was held in the theatre of Shell Centre, by courtesy of the Shell International Petroleum Co Ltd, who also provided tea.

The McWhirters told of the chance way in which they came to compile the *Guinness book of records,* at the request of Sir Hugh Beaver, then Managing Director of Guinness, when after a shooting party he failed to find any record of the fastest flight of a certain game bird. Chris Chattaway, who was on Sir Hugh's staff at the time (1955), mentioned that he had two friends at Oxford who made a hobby of collecting 'ests' and other such 'facts'. This began a chain of events, culminating in the appearance of both the *Guinness book of records* and the *Dunlop book of facts.*

The two brothers told of their main sources: other reference books, newspaper files, learned societies, television monitoring services, personal contacts. They also revealed three secrets of their trade—recipes for getting better results. One, they find, surprisingly, that they get more helpful service by writing from an address abroad than if they ask the same question from a home address; two, it is better to concentrate on an amateur enthusiast than seek information from a professional expert; and three, many a useful fact has been confirmed by deliberately 'flying a kite' with a false statement, or a surmise that a rival holds a record. They gave a word of warning on the use of unsuitable, though seemingly appropriate, sources such as the Old Bailey for criminal statistics, or HM Prison Commissioners on escape figures.

In answer to specific queries they touched on avoidance of copyright infringement and problems of defamation laws, described how they keep records of their sources, and gave statistics of staff time, etc.

ICSU—UNESCO Joint Project on the Communication of Scientific Information

The first session of the International Committee took place in Paris from 6th to 8th December under the chairmanship of Dr Harrison Brown, the Foreign Secretary of the National Academy of Sciences of the USA. Its main terms of reference were to 'investigate the feasibility of a world-wide science information system based on voluntary co-operation among existing and future information services'. The membership included:

B. W. Adkinson (USA)
N. B. Aratiunov (USSR)
G. A. Boutry (France)
H. Coblans (UK)
H. T. Hookway (UK)
H. Kaiser (W. Germany)
M. Kotani (Japan)
P. Lazar (Hungary)
A. Pérez-Vitoria (Unesco)
C. W. Sherwin (USA)

as well as representatives from international government organizations, regional governmental agencies and non-governmental organizations.

Since the existing situation in science information facilities and resources, particularly for the basic sciences, as represented by the disciplines covered by ICSU, was considered as the starting point, working papers* in subject fields as chemistry, physics; data for science and technology; on certain national and international documentation networks were presented. With the increasing importance of the international exchange of computer-based stores of information a special paper including an outline of a proposal for an International Bibliographical Description (IBID) was presented by C. W. Sherwin. It implied that certain basic information (authors, title and citation) should, at the time of original publication, be produced as a standardized minimal machine-language description and transmitted to all related centres. In effect this would be like a standard book number for all bibliographical units (periodical articles, reports, etc.).

It was finally decided that the following working parties would be set up: International standards for document identification; Evaluation, compression (abstracts, etc.) and organization of scientific information; International Institute for Research in scientific information; Needs of developing countries. Also an Advisory Panel on Existing Large Systems (such as MEDLARS, American Chemical Society Services) would be created. In principle the next Meeting of the Central Committee would take place late in July 1968.

* Some of the working papers are more generally available, e.g.

(1) Primary scientific publications, with special reference to physics, prepared by a UNESCO *Ad-hoc* Subcommittee. Paris, ICSU Abstracting Board (17 rue Mirabeau), October, 1967. (Chairman and Rapporteur: Prof. G. A. Boutry.)

(2) National Science Foundation. An overview of worldwide chemical information facilities and resources. Washington, D.C., N.S.F., September, 1967. (Obtainable from Clearing House, Springfield, Va. 22151.)

Keyword Retrieval Systems for Chemical Engineers

The Institution of Chemical Engineers gave a polished demonstration to an invited audience in London recently of the keyword information retrieval system which it has adapted and developed for use in chemical engineering. Many members of Aslib will recall the series of lectures on concept co-ordination given in 1964 by Mr Bart Holm of the Du Pont Company at the invitation of the Institution; as a consequence of these, the Institution set up a committee under the chairmanship of Mr René Snel of Shell—who is also a member of the Council of Aslib and was Chairman of the committee responsible for the successful Annual Conference in Scheveningen in 1966—with the task of making 'a co-ordinate indexing system and a word list (thesaurus) as an aid to the timely acquisition of chemical engineering information'.

The results of the committee's work, critically tested and refined, were admirably demonstrated by Mr B.E. Evans of the Institution's staff. Although developed in the first place for chemical engineers, it is hoped that the system can be extended and adapted for use by other institutions represented in the Council of Engineering Institutions. The aim has been a simple, practical method with an obvious appeal to the engineer, and the Institution proposes also to offer an advisory service in support.

NEW MEMBERS

CORPORATE

Name	*Locality*	*Representative*
Air Products Limited	Surrey	Miss S. Richardson
Bank of England	London	G. O. Randle
British Iron & Steel Research Association	Sheffield	K. W. Atkin
British Sidac Ltd	London	R. V. Mott
Canada. Freshwater Institute	Canada	K. E. Marshall
W.Canning & Co Ltd	Birmingham	R. Allen
Centre for Advanced Study in the Developmental Sciences	London	Dr J. A. Ambrose
Centre National de Recherches Agronomiques	France	Mlle Cagnac
Cochran & Co Annan Ltd	Dumfriesshire	H. Page
Delta Metal Co Ltd	Birmingham	R. K. White
Dundee Commercial College	Dundee	M. Fodor
Ealing Scientific Limited	London	P. Coventry
Electricité de France	France	Mlle M. Boucher
Fitzpatrick & Son (Contractors) Ltd	Hertfordshire	J. N. Taylor
Foster Wheeler John Brown Boilers Ltd	London	Mrs R. A. Anderson
Hawker Siddeley Dynamics Ltd	Hertfordshire	Mrs A. V. Conchie
Home Office Central Research Establishment	Berkshire	M. Swain
Institute National des Sports	Tunisia	R. Kocourek
Institute of Transport Economy	Norway	S. A. Jessen
Lankro Chemicals Limited	Manchester	Miss J. Hercock
Leeds College of Education	Leeds	R. B. Bateman
Modo Products (Chemicals) Ltd	London	G. Peryer
Pan Britannica Industries Ltd	Hertfordshire	M. G. Howes
Parana. Universidade Federal do Parana	Brazil	Miss M. A. de Castro Correia
Ranger Fishing Co Ltd	Northumberland	J. F. Purdy
Save and Prosper Group Limited	London	M. Crosbie
Douglas Stephen & Partners	London	Miss J. Fielding
Stobart & Son Ltd	London	R. Addison
Tottenham Technical College	London	Mrs E. Morris
Venesta Ltd	London	Miss C. Fuller

INDIVIDUALS

Name	*Locality*
Böhm, A.	Berkshire
Eyre, J. J.	London
Gillam, Miss G. O.	Warwickshire

Name	*Locality*
Hamer, Miss A.	Buckinghamshire
Humpage, Miss C. A.	Surrey
Ireland, R. E.	Leicestershire
Kirk, Miss J. R.	Cardiganshire
Lewis, Miss B. S.	Australia
Moss, R.	Yorkshire
Sachedina, Miss R.	Cardiganshire
Walker, Miss B. A.	London
Waydenfeld, Dr S. W.	London

Lectures at Ealing

A series of six afternoon lectures entitled 'Trends in special librarianship' will be presented at Ealing Technical College on successive Thursdays from 22nd February to 20th March 1968. These lectures are designed primarily for practising librarians working in special libraries. Further details may be obtained from the Director of Library Courses, School of Liberal Arts, Ealing Technical College, Ealing W5.

Chicago scholarships

The University of Chicago Graduate Library School will offer approximately thirty scholarships and fellowships for MA, Post-Masters and PhD programs for 1968–69, in amounts up to $6,700. Included are six predoctoral and two postdoctoral training stipends ($2,400 and $6,000 respectively, tuition-free) for medical librarianship. Application deadline for scholarships and fellowships is Thursday 1st February 1968. A number of research assistantships will also be offered; these are on a half-time (twenty hours a week) basis and are compensated at an hourly rate depending on the qualifications of the student. Applications for the latter will be considered at all time during the year. Inquiries should be addressed to the Dean, Graduate Library School, University of Chicago, 1116 East 59th Street, Chicago, Illinois 60637.

Mr K. Howard Drake

The sudden death of Mr K. Howard Drake brings to an end twenty years of distinguished activity as librarian of the London University Institute of Advanced Legal Studies. Mr Drake was also well known as General Editor of the *Index to Foreign Legal Periodicals*. In 1965 he was elected President of the Internation Association of Law Libraries.

New Year's Honours

I. Maddock, CB, Controller of Industrial Technology, Ministry of Technology.

Dr N. F. Astbury, CBE, Director of British Ceramics Research Association, and until lately Chairman of the Committee of Directors of Research Associations, on which Aslib is represented. In that capacity he was until a year ago a member of the Advisory Committee for Scientific and Technical Information.

Colonel P. H. Lloyd, CBE, Chairman of the Leicester County Council, and member of the Library Advisory Council (England).

R. E. Barker, OBE, Secretary of the Publishers Association. Mr. Barker has recently undertaken for Unesco a study of the copyright aspects of photocopying.

Dr D. Hicks, OBE, until recently Director-General of the British Coal Utilization Research Association.

Dr D. McNeil, OBE, Director of Research, Coal Tar Research Association.

SCIENTIFIC AND TECHNICAL DOCUMENTATION—AND CO-OPERATION IN THIS FIELD

M. DUCAS

Secrétaire Technique, Verneuil Laboratory, CERCHAR

Paper presented at the 41st Aslib Annual Conference, Harrogate, 9th–12th October 1967

THIS paper is based on the views and comments put forward by some thirty experts who head the documentation branches of French technological research establishments or institutes co-operating with the Commission de Documentation de l'Association Nationale de la Recherche Technique.

For the purposes of this paper, each expert outlined the present state of his relations with similar Common Market establishments and with countries outside, particularly the United Kingdom. Each had his own story to tell of successes and failures, of advantages and drawbacks, of fruitful and barren ventures, and of helpful or unhelpful action on the part of national or international organizations.

While quite aware of them, we felt that activities of general scope organized on a world-wide basis, such as those concerned with patents (ICIREPAT) or numerical data (CODATA), had best be omitted from our investigation. At all events their development requires co-operation among the scientifically and industrially advanced countries. We have therefore endeavoured to arrive at a better understanding of the factors likely to promote co-operation in scientific and technical information.

Where it exists, co-operation has been organized by the scientific or professional sector, the term sector being adopted in the sense in which it is used by the OECD.

The geographical scope of sector co-operation is variable. Work is done either by world organizations (Meteorology, Health) or under far-reaching international agreements, sometimes supported by international organizations (telecommunications, atomic energy, aviation and space research, railways).

Except of course for defence secrets, in no case did we find sector co-operation to be limited by political considerations. Two out of the three European Communities cover technical fields, i.e. the European Coal and Steel Community and Euratom. The United Kingdom as observers on the scientific and technical committees of the ECSC, while in translation matters the National Coal Board co-operates with the Centre d'Etudes et Recherches des Charbonnages de France. The Euratom documentation centre is in close contact with its opposite numbers in the United Kingdom and America. (Its work is incidentally well known to Aslib, from an article by Mr L. N. Rolling in the *Journal of Documentation*, June 1966.)

Sector co-operation is therefore the most usual form. It may here be mentioned that the OECD has helped to compile a considerable amount of information on this subject and has done much to promote more frequent relations, among specialists, with lasting benefits. It will be remembered that OECD surveys were conducted between 1962 and 1965 in the following sectors: ceramics, glass, highways, shipbuilding, energy (gas, coal, oil and electricity) mechanical engineering and railways. In all these sectors international co-operation has attained a varying degree of development, and both British and French industry is sufficiently represented in each to warrant the claim that contacts have now been established.

I should now like to describe the situation as outlined in the replies I have received from my French colleagues working with similar establishments abroad. I propose to divide these into four categories, although I do not claim to include every case of significance. These four categories are:

1 centralized international schemes.
2 co-operative international schemes.
3 national schemes supported by limited international agreements.
4 occasional contacts and exchanges.

1.—Centralized International Schemes

In 1951 the International Union of Railways set up the Bureau International de Documentation des Chemins de Fer (BDC) which is administered by the Société Nationale des Chemins de Fer Français (SNCF) in Paris. The SNCF is assisted in its task by a technical committee whose members are representatives of the European railways.

The Bureau collects documentary material and answers requests for documentation from its members. It publishes a documentary bulletin in four languages (English, French, German and Spanish), giving abstracts of articles or books dealing with technical, administrative, economic and legal questions. It has established links with many documentation centres concerned with railways and other sectors, particularly with the OSShD, which is the opposite number of the International Union of Railways in the Eastern countries (China, Rumania, USSR, etc.). A working group of the BDC is responsible, within the FID, for the UDC classification on railway transport.

The BDC prepared the second edition of the General Dictionary of Railways Terms which appeared in 1966; it includes 10,457 terms in French, German, English, Italian, Spanish and Dutch. It is being translated into Czech, Chinese, Hungarian, Polish and Russian by the OSShD. The BDC makes many translations which, through the CNRS, are reported to the European Translation Centre in Delft.

The International Labour Office in Geneva administers the International Occupational Safety-Health Information Centre (CISOC). Its membership consists of thirty-seven countries (including France, through the Institut National de Securité) and its reference data are published in three languages: English, French and German.

2.—Co-operative International Schemes

Under the sponsorship of OECD a group of directors of road research laboratories has set up the International Road Research Documentation (IRRD), which has been in operation since 1st January 1965. Twelve countries have joined.[1] Documentary material is processed by the members and indexed in one of three languages, i.e. French, English and German. A trilingual thesaurus has been compiled with an alphabetical list of keywords in the form of arrowed diagrams. All this work represents a quite exceptional co-operative effort in view of the linguistic difficulties which have had to be overcome. The exchange of information also applies to current research programmes.

Under the sponsorship of the Food and Agriculture Organization (FAO), the international organizations dealing with agriculture have entered into an agreement to create an International Centre of Documentation on Agricultural Machinery in Paris. Pending effective operation of this establishment and as a preliminary step, a documentary bulletin in French and English is issued co-operatively by twelve countries;[2] the editing work is shared among them, while the task of preparing, issuing and circulating the bulletin is assumed by France.

Another co-operative international scheme reported in the press is the agreement by a number of European chemical companies to share the work of preparing patent abstracts. One of them gave me the following details:

The 'Patent Documentation Group' (formerly the Patentring) was started ten years ago. Its membership consists of sixteen European companies:

in Germany: BASF, Bayer, Hoechst, Hüls and Dynamit-Nobel.
in France: Rhone-Poulenc.
in Switzerland: Ciba, Geigy, Sandoz.
in the United Kingdom: BP and Distillers (its chemistry section has become BP Chemicals).
in Holland: Staatmijnen, TNO, Shell, Unilever.
in Italy: Montecatini-Edison.

Its object is to share the work of abstracting some forty thousand chemical patents every year (American, Austrian, Belgian, British, Dutch, French and German patents). Each company undertakes to prepare patent abstracts in a given field, and circulates them among the other members. The group worked out standards for the presentation of the abstracts and developed a method of making abstracts in a most comprehensive way, so to comply with the requirements of its members. In addition, attempts are being made to codify abstracts in some special fields. Experience in mechanization gained by its members is also exchanged in regular meetings.

3.—National Schemes Supported by Limited International Agreements

Many examples may be quoted to illustrate this type of co-operation. I will begin with the energy sector (coal, gas, oil and electricity), on which a very comprehensive report by Mr Nerot, Vice-President of the Institut Français des

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[1] Austria, Belgium, Canada, Denmark, France, West Germany, Netherlands, Norway, Portugal, Spain, Sweden and the United Kingdom.

[2] Austria, Belgium, France, West Germany, Italy, Luxembourg, Netherlands, Portugal, Spain, Switzerland, the United Kingdom and the United States.

Combustibles et de l'Energie, was submitted at a meeting of the OECD on 29th May 1964.[1] Nineteen French Institutes are listed in the report. The Centre d'Etudes et Recherches des Charbonnages de France, for example, participates in exchanges with the International Labour Office in Geneva, the National Coal Board in London, the Safety in Mines Research Establishment in Sheffield, etc. It has agreements with other British, German and Belgian coal institutes for a translation pool, one use being in connection with the preparation of congresses. The European Coal and Steel Community helps to pay for translations from difficult languages. France and the United Kingdom also exchange some of their translations under an agreement negotiated between their coal industries. Again in the same field, it must be mentioned that the ECSC finances the processing of documentary material and the publication of abstracts in the medical sector (Pool de Documentation médicale minière).

There is a fair number of other agreements of this type which invariably extend beyond the confines of the Common Market countries: for example;

in shipbuilding a club-like organization exists,[2] a leading member being the British Ship Research Association;

in the ceramics industry a working group of eleven countries has been set up,[3] whose bulletin is translated in Spain, Italy and Brazil and which organizes exchanges of reference data and patent abstracts between France, Germany and the United Kingdom.

Brevatome, a company which administers the patents of the French nuclear energy industry, co-operates actively with Euratom and the German, Netherlands and Italian nuclear documentation centres;

Sud Aviation and the Office National de Recherches Aérospatiales (ONERA) are in contact with Eurospace and the major foreign services, including the Ministry of Aviation;

In the meteorological sector many contacts have been established through the World Meteorological Organization;

The Association Française pour l'Accroissement de la Productivité and the other similar foreign associations, which have formed an International Association to continue their co-operation previously sponsored by the OEEC.

The Institut de Recherches pour les Huiles et Oléagineux (IRHO) co-operates in technical matters with about a hundred institutes in many different countries. Within the Common Market, a symposium organized in Paris by the IRHO in 1964 was in fact the first meeting held by an international association on the agronomics of tropical oil-seeds, with Belgian, Dutch, French, German and Italian scientists participating.

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[1] This report, together with the national reports, led the OECD to prepare a comprehensive table showing the fields of interest of a large number of European and American documentation centres. This table, entitled 'Centres dealing with information on heat and energy processes', was published in the *Institute of Fuel Bulletin*, no. 319, August 1967, p.359–73.

[2] Common Market countries (except Luxembourg) + The United Kingdom and the Scandinavian countries.

[3] Austria, Belgium, Denmark, France, Germany, Italy, Norway, Netherlands, Sweden, Switzerland, the United Kingdom.

The Union Technique Interfédérale du Batiment et des Travaux Publics co-operates actively with national organizations in Australia, Canada, Germany, the United Kingdom, etc. It exchanges its research reports with institutes in many countries.

Private companies, such as the Société des Ciments Lafarge which with others sponsors a technical research committee consisting of specialists from the Common Market and Switzerland.

4.—Bodies which have only Occasional Contacts and Exchanges

There are many of these bodies. Generally speaking they would like to co-operate more actively. The obstacle appears to lie in the vastly different structures of the economic sectors concerned and in achieving mutually satisfying exchanges. This seems to be true in such sectors as mechanical engineering, foundry work, automobile manufacturing, the timber industry and in oils and fats. Occasional contacts are established either at congresses or when problems of standardization arise. Services are rendered by one country to another because the top men know one another personally, but there can be no real co-operation in the matter of documentation, whether for the reasons I have already mentioned or because one of the parties feels quite capable of acting on his own. Sometimes linguistic problems make contacts more difficult, but this objection is hardly a serious one where Franco-British relations are concerned. Some centres are very anxious to change this state of affairs. To my mind a favourable sign is that some among them are establishing contacts in order to exchange research programmes.

Although it does not come within any of the four categories listed above, the Centre de Documentation du Centre National de la Recherche Scientifique (CNRS) must be mentioned owing to its importance as a source of information. This Centre, headed by Professor Wyart, publishes an abstracts bulletin divided into eighteen specialized issues which contain over 400,000 abstracts annually, circulated to over twenty-five thousand subscribers. Some of these parts are compiled with the assistance of specialized documentation centres. Some are also circulated just as they are, but with an appropriate cover, through scientific societies abroad. Thus eighteen hundred copies of the CNRS bulletins dealing with electron microscopy and the structure of matter are distributed in the United States by corresponding American Societies. The International Unions circulate the Bulletin d'Astronomie and the Bulletin d'Histoire des Sciences et des Techniques, the latter being sponsored by Unesco. The Centre de Documentation du CNRS is willing to enter into agreements with documentation centres abroad, with a view to co-ordinating activities and possibly to sharing tasks. The library of the Centre has 13,500 runs of periodicals. Its photocopying division deals with 275,000 orders a year, with an annual increase of 10 per cent. The Centre de Documentation du CNRS makes four thousand translations a year (more than fifty-five thousand pages) and lists the translations made in France. It can be seen immediately from the co-operative central reference file whether a translation has been or is being made by a third party prepared to make it available. In France there is therefore no excuse for translating a document already translated and card-indexed by the CNRS. Contacts with the

European Translation Centre (ETC) at Delft enables translations in other Western languages to be obtained, particularly in English, provided the Centre has a record of their existence.

It is time to speak of the reasons for the successes and failures I mentioned as having been experienced by the centres. It is everywhere agreed that the greater mass of information available will call for efforts at national and international level to facilitate contacts and faster critical appraisal in technical literature. Everyone therefore hopes that co-operation will increase the spread of information, since this is the mainspring of research and technological progress.

Judging by the replies received from my colleagues, international co-operation in documentation quite clearly becomes easy when as many as possible of the following requirements are fulfilled:

1. industrial and commercial structures must be similar;
2. industries must be at the same level of technological development;
3. technical and scientific co-operation (governmental or private) must go further than documentation, e.g. there must at least be contact between research programmes;
4. the documentation services concerned must be consulted when agreements are negotiated;
5. the documentation services must be in the vicinity of a research department or responsible to it;
6. scientific standpoints must be similar and be reflected for example in symposiums or congresses among specialists concerned or the issue of glossaries;
7. strict intellectual discipline must be observed (particularly in regard to terminology and classification) and there must be frequent meetings;
8. financial resources must be determined collectively;
9. last, but not least, the co-operating parties must be able to speak each other's language; in fact this is not an obstacle between the French and British.

Such are the nine rules for smooth co-operation. If they are disregarded nothing but difficulties, misunderstandings, reservations, divergences and ultimately failure will result.

I was also told that a good way to promote understanding and co-operation is to bring specialists together in order to prepare specialist glossaries, particularly in connection with the preparation of congresses or conferences.

Another method, relatively unexplored as yet would consist of exchanging trainees and even staff members between documentation centres and libraries in different countries. All the preceding remarks show that co-operation is easier to establish between professional organizations than between commercial enterprises.

My general conclusion is that sector co-operation is one of the most promising paths that can be chosen, rich in rewards for all who travel it. It requires few preliminaries for European countries, whose industries and techniques are largely similar in outlook, structure and level of achievement. It is a road which transcends all frontiers, and one which I personally trust many industries and organizations will tread together.

THE EFFECT OF MEMBERSHIP OF THE COMMON MARKET ON INFORMATION WORK

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Paper presented at the 41st Aslib Annual Conference, Harrogate, 9th–12th October 1967

THE 'Common Market', now fused with the European Union for Coal and Steel (usually abbreviated to the 'Mining Union') and with the European Atomic Energy Community, is primarily founded on economic considerations to create a common productive European market. I need not say any more about this, since Great Britain has expressed the wish to become a component part of this European association. Lord Gladwyn considers this decision to be more significant than the declaration of war of 1939; he also considers it to be the end of an era.[1]

It is quite obvious that the recent flood of economic and financial negotiations has led to new information on the countries concerned and their scientific and economic potential becoming available, and has thus resulted in an abundance of treatises, journals, annual reports, conference reports and technical reports. At the same time a mutual exchange of information, without charge, especially in the form of reports, has begun between these six countries. Here already we have evidence of the effect of membership of the Common Market on information work; it may even give rise to the hope that European civilization, which up to the present has been so uncertain and incomplete, deceptive even, will not remain fixed at a material level.

The most advanced of the information systems is that of the European Atomic Energy Community. In this organization, a general department known as the Directorate Dissemination of Information, and a subsidiary department, the Centre for Information and Documentation (CID) have built up a network of Euratom libraries and information centres with a main centre and a main library in Brussels. By means of a semi-automatic data processing system involving approximately 600,000 titles, a quick reply to inquiries concerning specialized literature on nuclear research is guaranteed.

A full list of the firms involved comprises about three thousand enterprises, both in the Union and in foreign parts. This catalogue, which is constantly growing, also supplied the basis for the handbook on sources of supply in the European atomic industry. This book, which was published in 1966, contains details of approximately 350 nuclear and paranuclear products and 1,200 supply firms in the countries of the Community.

An investigation begun in 1965 concerns American enterprises and their involvement with industries in Europe; it covers more than two hundred American firms. The *Catalogue of the nuclear centres in the European Atomic Society* is to appear in its fourth edition in 1967.[2]

The translations which are announced monthly in the *Transatom Bulletin* constitute a particularly crucial point. Moreover, in a supplement to this journal, called *Eastatom*, literature from Eastern Europe and other eastern countries is announced; these are titles which do not appear as cover-to-cover translations and are not referred to in *Nuclear Science Abstracts*. About 120 to 150 important works a month are retrieved in this way from a total of approximately ten thousand titles from the Eastatom department at the Central Library of the Nuclear Research Establishment, Jülich.[3]

A feature of the information centre at Euratom is its well-organized cooperation and collaboration with corresponding bodies in Europe. An Advisory Council, which consists of the leading information officers of the six Euratom countries, has the task of supporting consultatively the development of the Centre for Information and Documentation of Euratom. The heads of the central agencies for atomic energy documentation of the six Euratom countries meet annually for deliberation and consultation; finally, the librarians of those libraries which have special collections of nuclear scientific literature also meet annually for a two-day conference.

All these conventions, conferences, meetings and advisory groups promote the exchange of information and the improvement of collaboration, and help to keep people informed about the work and aims of the Centre for Information and Documentation.

There is no doubt that after the alliance of the Common Market with the European Union for Coal and Steel and with Euratom, European documentation on agriculture, coal and steel, and for all mining requirements, will also be raised to this level; thus the information and documentation centre of Euratom could furnish a model for a European Information Centre. It is also conceivable that systems of information in other fields of science, and in the arts, too, will follow, assuming that fields in which there are common spheres of interest are involved.

All these aspirations, to raise the Common Market above the level of a mere tariff-union and to bring about better collaboration in the realm of information and documentation, are also furthered by the OECD in Paris, although at present there is no intention there of building up a real European information centre.

On the other hand, as stated in a chapter entitled 'Recording of results and dissemination of information' in the 15th Joint Report of the European Coal and Steel Community (March 1967), 'all is not over when the research is done. It is necessary also to make use of the results and profit by them. But in order to improve announcements of publications and to make the results of research more easily accessible, the authorities must lay aside the obstacles which stand in the way of their distribution. Though considerable effort is involved, the most promising method is to create intermediary centres of information, such as the Centres for Documentation and Information for specialized literature on new methods in medicine, ergonomics, medicine for trade and industry, automation, methane, and the use of prereduced ore.'

In addition, at the moment four information sessions are held each year, dealing with progress in research and technology in particular fields, e.g. labour medicine and labour sanitation.

Similarly, a memorandum issued in March 1967 by the three European unions deals with problems arising from scientific and technical progress in the European Union.[4] This memorandum arose out of concern for the technological and scientific condition of Western Europe, and the danger of scientific backwardness there, which indeed has already occurred in comparison with the United States and the Soviet Union. In view of this the Cabinet Council is called upon to proceed energetically against the causes of this technological backwardness and to determine what procedures are needed for a common policy on science and research. The three Executives were to submit concrete suggestions to the Cabinet Council at the beginning of November 1967.

In this memorandum, three particular measures, among others, are intended to promote better conditions for scientific and technical progress:

1 current information on all competent authorities and enterprises,
2 consolidation of the European patent system,
3 a unification of norms and standards.

Working on the same lines, a research commission, formed at the request of a group of European manufacturers, is investigating the causes of technological backwardness in Western Europe. This backwardness is indicated, for example, by the fact that Western Europe is paying altogether two to three times as much in royalties on patents to American firms as the American firms pay themselves. The head of this European research board, the Belgian professor Daniel Janssen, suggests that a way of counteracting this very alarming development, apart from the possibility of government or union influence, would be to speed up the circulation of scientific information from the universities and public institutions to commercial enterprises.[5]

In doing so, one must not entirely disregard three principles. Firstly, one must beware, at all costs, of doing something which will not work simply for the sake of having done something. For the classification and also the sale of information is guided solely by the state of the market, that is to say, by a common interest among inquirers. Co-operation also brooks no complicated organization, if it is to be really labour-saving. For this reason the national or international collaborative groups are numerically not very large, and different groups serve similar purposes.

There is no point, therefore, in advocating some unlimited policy of documentation which is to lead to a Utopia. The exchange of information between individual centres can certainly be valuable, and can benefit the headquarters organization too. But it is better to realize, to recognize, and to satisfy actual demands. The highest goal should be to supply the real, the true needs of the scientists for information in research and industry at the right time and in the right place.

With this I come to the second principle, which I consider necessary for a European system of information: above all one should disturb as little as possible the functioning of existing information services and information centres; according to the German poet Schiller 'Thoughts are free' and their range is unlimited, and not to be hindered by national boundaries and tariff stipulations. Thus, for example, the achievements of the English Nobel Prize winners, Crick, Wilkins, Kendrew, Hodgkin, Huxley and Crowfoot, and the findings of the four Nobel Prize winners since 1961, who are living in Germany

Rudolf Moesbauer, Hans Jensen, Karl Ziegler and Feodor Lynen, truly belong to the whole world. They are already known across all boundaries to all other scientists and academicians in the world.

A few more examples of existing international co-operation with regard to similar fields of interest should clarify the matter further.

(*a*) International collaboration has occurred in the establishment of a uniform documentation for literature on cancer, whereby a thesaurus of nine thousand technical terms was compiled by the Institute for Medical Documentation and Statistics in the Cancer Research Centre at Heidelberg, in co-operation with the corresponding departments in France.

(*b*) In 1966 a Centre for International Documentation in Chemistry was founded at Frankfurt. This centre intends to promote collaboration in the field of chemical documentation with all its might, and has prevailed against the independence of the German member firms Bayer Werke in Leverkusen, Badische Anilin- und Soda-Fabrik in Ludwigshafen and Farbwerke in Hoechst —at all events, in the realm of information and documentation.

(*c*) Efforts are also under way to attain some sort of order out of the jungle of patents classification. Here it is a question of getting rid of national barriers and of co-ordinating traditional and international laws. Incidentally, through the close co-operation of the German Patent Office in Munich with Euratom and with other departments of the European Union, a number of welcome improvements have already been acheived in the supply of patents.

(*d*) In this country there has already been in existence for some time, outside the influence of the Common Market, the International Co-operation in Information Retrieval among Examining Patent Offices (ICIREPAT), which has been striving for years for mutual, joint patent documentation and patent classification.

(*e*) In the realm of chemical patents there has been, for the past ten years, co-operation among the large European chemical firms, the so-called patent-documentation-group (PGD). A paper dealing with the activities of this group was published a short while ago.[6] Its membership includes firms in England, Germany, Switzerland, Italy, France and the Netherlands.

From these examples it is evident that the praiseworthy efforts of the Common Market towards a perfect international organization for information and documentation need to be aimed less at demolishing barriers than at creating certain improvements and giving, here and there, an additional, more emotional impulse.

I would like now to go briefly into the structure of the documentation and information systems of the Federal Republic of Germany, where the various documentation centres and special libraries are organized on a decentralized basis. A survey of the documentation centres of the German Federal Republic is available in the form of the *Catalogue of Information Centres* (6th edition, 1967), which includes approximately five hundred documentation centres in the German Federal Republic.[7] A corresponding list of the special libraries of the BRD is found in the *Catalogue of Special Libraries*, which was published in 1965; this includes 522 special libraries, and a revised and enlarged edition will appear in the near future.

With all these specialized centres and firms it is, of course, necessary to know whether these places supply information; if they do, one still does not know whether there is a specialist on the staff of a given centre; and if one knows that there is a specialist, one still does not know whether he is able to answer the questions within a reasonable space of time.

Functions, positions and relations are not so critical in a decentralized system as in a centralized system of documentation. However, a few institutions see to it that decentralization does not become another word for a high degree of disorder and chaos. These are the institutions whose aim is to strive for comprehensiveness, control and order in the field of information: the Deutsche Gesellschaft für Dokumentation, the Arbeitsgemeinschaft für Spezialbibliotheken, the Institut für Dokumentationswesen, and the Ministry of the Republic for Scientific Research, which in 1966 issued its 'Guiding Principles for a National Documentation and Information Policy in Science and Technology' aimed at an integrated national documentation and information system.[8]

We should not like to renounce existing bilateral relations between England and the Federal Republic with regard to information service. Unfortunately, however, we have the feeling that the basis for fruitful and flourishing collaboration in the domain of information work has not yet evolved, although I know that the government offices of the German Federal Republic would very strongly support close co-operation. Deficiencies are still found which are confirmed in the memorandums of the Common Market mentioned earlier.

From this, the third essential principle should be deduced: one should determine where definite gaps in the field of information occur and recommend the furtherance, the promotion, and the creation of additional specialist information centres in the countries concerned. In the ideal case only specialists should be appointed to posts in the chain of information service, since otherwise 'snowballs' can be passed on to others, which with time become harmful avalanches; or large literary empires could be erected, which consist of useless material. Our century offers an abundance of examples of how the lack of crucial information at a particular time can induce a catastrophe. If one had known, for example, that with the increase of the discount rate of the German National Bank in 1931, not only many of the German private banks would have to close their doors, but also that the number of unemployed in Germany would double in a short time from one million to two million, and would thereby create the provisions for a dictatorship, then perhaps one would have been able to redirect the course of history by means of 'prophylactic' information. Perhaps, too, better information would have induced the British Prime Minister Ramsay MacDonald to change his mind in agreement with Briand and Stresemann in 1929, at the tenth Plenary Session of the League of Nations. Lord Gladwyn admits: 'If Ramsay MacDonald had supported the plan, and if one had been successful in realizing it, then there definitely would have existed a chance of averting the second world war'.[9]

You yourselves certainly also know of a number of examples after 1945 of unfortunate discoveries, of catastrophe of duplication of work, and of realizing that one was on the wrong track only after one had already committed the error. These misfortunes perhaps could have been avoided, if one had been properly informed at the right time. This, of course, also holds true for the private sector. Here, at all events, measures for the advancement of definite fields, by a European organization, are still conceivable and useful. Above all, the advantage is to be gained primarily in public or government departments, perhaps in the field of the organization of patents, or in lending services, especially the lending of theses from England.

Here a programme for the distant future lies before us, namely that further organizations for collaboration should be brought about through the Common Market, and that the experience acquired should be stimulatingly communicated to all documentation centres that are working together. If one were to succeed, through a fusion of European associations, to extend the Euratom system to other realms (beginning perhaps in the fields of agriculture and coal and steel and later possibly in additional fields) and if it were manageable, at the same time, to take such an important partner as the United Kingdom into consideration, then we would have attained in this manner, as far as possible, that which the Americans have always expected from us, and which has always caused such great organizing difficulties, namely, the gradual foundation of a European information system, which could enter into a true partnership with the American system, and which could, in doing so, yield a profit to all parties concerned. It seems to me that the European associations offer an organizational framework in which such large projects could be jointly realized.

I am convinced that everyone here present knows what an enormous amount of work lies before us, and how many obstacles must still be cleared away. But we also realize that science, the literature pertaining to it and its processing and compilation must be as international as politics. The necessity for co-operation in order to control the huge bulk of literature is sufficiently great to force rival firms in the different countries into the closest conceivable co-operation; this has already happened in part.

Where does England stand at the moment? We know and esteem highly the great organization of Aslib, of which also German individuals and organizations are members. We are acquainted with Aslib's publications, and remember very well the lecture on 'Information Services in the United Kingdom of England, Scotland and Northern Ireland', given by Mr Wilson on 24th October 1962, in Bad Dürkheim in Germany, at the 14th Annual Conference of the Deutsche Gesellschaft für Dokumentation.

But encounters between England and Germany are unfortunately of an accidental nature. They are restricted essentially to a limited lending and exchange service via a special application form for libraries abroad. There is still a lack of any regular, well-proportioned exchange of practical knowledge and information. We still lack an 'unbroken thread', for a permanently established collaboration. We have almost the impression that cultural relations between England and the continent were much better in the days of Boniface of Wessex and Willibrord of Northumbria, when these English monks brought Christian civilization to us. But that is a very long time ago, and in the meantime, the distance of twenty-two miles across the Channel has, for the most part, been much greater than the distance from London to Canberra. It seems to us that, as far as scientific literature is concerned, the United Kingdom is oriented solely towards the United States and the Soviet Union, and has focused its attention on these giants alone.

However, the fact that you have invited me here to talk to you on this subject suggests that this tendency is not irreversible. We may look for an improvement in the mutual exchange of literature and information, whether England joins the present system of the Common Market—which we certainly wish—or not. For whether the hope, which Arnold Joseph Toynbee has expressed, that England is seeking to unite itself with its continental neighbours, is fulfilled in any degree whatsoever, depends upon us too, upon our understanding, upon a mutual appreciation of these problems which have closed in upon us all during this last phase of our history—finally, therefore, upon a better exchange of information with each other. It certainly is not wholly a question of 'To be, or not to be'. That is not the question, but 'It is a consummation devoutly to be wish'd'.

NOTES AND REFERENCES

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2 EUROPEAN ATOMIC ENERGY SOCIETY: Tenth complete report on the activity of the society (March 1966–February 1967). April 1967. Document Nr. 22.
3 Originals in the form of xerox copies, microfilms, or also translations can be requested at 40 per cent of the cost of production through Eastatom in Jülich.
4 Europäische Gemeinschaft of April 4 1967, p. 12.
5 Handelsblatt, Düsseldorf, of 23–24 June 1967, p. 21.
6 By Dr Suhr, BASF-Patent department, Ludwigshafen.
7 Compare also Barlen, Sigrid: Die Dokumentation in der Bundesrepublik. In: *Der Archivar,* 19 (1966), 42, columns 147–60.
8 Published in *Nachrichten für Dokumentation,* 18 (1967), no. 1, p. 15–18.
9 England asserts itself. Ed. by Peter Coulmas. Hamburg, 1962, p. 102.

DISCUSSION

The Chairman said that we could not afford to wait until co-operation had been established before standardizing, because in the meantime local standards would be made which would not be compatible. Positive co-ordination was required before co-operation would become possible. It was over-optimistic to think at this stage in terms of an overall patent system for Europe and the USA, so much standardization work still needed to be done.

Mr Frank Smith (British Transport Staff College) suggested that before discussing the European Economic Community one should be familiar with the Treaty of Rome, which was available from the EEC's London office. He recommended a paper by Stuart in the current issue of *Management Today* on EEC Transport and the UK.

Mr A. H. Holloway (NSTIC) said that he would like to emphasize Dr Reichardt's last paragraph. Collaboration did indeed depend upon ourselves, and the presence of individuals who had the will and the ability to take a lead was essential. But organizations were also necessary. At present many were small, weak and impoverished, and consequently too much depended on individuals. More effort had to be put into international collaboration and the organizations should be strengthened.

Mr Simon Francis (North-Western Polytechnic) said that the Federal Ministry had issued a proclamation for a national documentation policy, and work toward this end had been done in the USA. Strong pressure should be applied for comparable work and statements in this country.

Mr J. H. R. Marns (AERE) said that co-operation already existed in the exchange of nuclear information and in the development of *Nuclear Science Abstracts* as an international abstracting service. He asked whether the bibliographical publications of the Gmelin Institut ZAED were intended mainly for use in Germany, since they were largely compiled from references which had already appeared in *NSA*.

Dr Reichardt replied that the abstracts were, in intention at least, international. He was not, however, authorized to defend the Gmelin Institut's publication policy.

Dr R. T. Bottle (University of Bradford) suggested that, in view of the allegedly low status of university library staff in some common-market countries, there might be an influx of information workers into the UK if this country signed the Treaty of Rome.

Mr Leslie Wilson (Aslib) said that M. Ducas and Dr Reichardt had accepted the concept of Euratom, representing the pooling of European resources for the development of atomic energy. Could they accept the concept of 'Euraslib', representing the pooling of European resources for the development of documentation?

Dr Reichardt said he hoped that the Euratom system would be the model for other subjects but there was a long way to go yet in the information field. Much would depend on the personalities of heads of libraries and national rulers. He was convinced that all the larger centres of information must open their shelves.

Mr P. D. J. Rae (IBM(UK)) asked for comments on the value of the MARC project. What steps were to be taken for active co-operation within Europe?

Dr Reichardt said that a memorandum on this had been published in March (see p. 14–15) and consultation was to take place in November. The Iron and Steel Community was a tariff structure, but wanted information exchange too.

BEFORE THE MACHINES COME

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Paper presented at the 41st Aslib Annual Conference, Harrogate, 9th–12th October 1967

BEFORE the spread of printing the chief concern of the librarian was to conserve the manuscripts in his charge. Their value, and the difficulty of replacing them, made their safety paramount. Scholars would willingly travel great distances to the collections and endure inconvenience in order to use the documents they needed. Libraries with collections of manuscripts evolved efficient systems to ensure conservation of their treasures, and their management was relatively simple. The coming of printing and the consequent mass production of documents has forced most librarians to reconsider the relationship of readers and documents. In most cases their readers' time is now much more valuable than the costs of making good losses from, and damage to, the documents in their charge. This applies even to the esoteric writings of those secret societies of the modern world—companies and government departments. The security measures used to guard the documents must not waste the time of the initiates whom they are intended to help, or prevent the documents from being fully available to them. Indeed, the librarian's chief concern now is to make his documents fully available to the readers whom they will help.

Since the fifteenth century the output of documents has repeatedly been increased and diversified by the introduction of further inventions. The Fourdrinier paper making machine, the application of steam and later electricity to the flat bed and rotary printing presses, photography, lithography, typewriters, data processing and transmission, disc and tape recording and many other devices have allowed an enormous number of sources to issue a wide range of documents. The bibliographical control of these is extremely difficult and requires the co-operation of subject experts in many fields. At the same time, librarians have to serve more and more readers with increasingly varied demands. Information workers have joined with librarians to help tackle this problem and to offer evaluation services where the information seeker has not the time to search available documents for himself. In spite of this concerted effort, conventional library and information services cannot keep up with the demands made on them. Machines are helping to increase the number of documents produced. They are also helping to diversify and complicate the demands made on library and information services by their users. Can they help librarians and information workers to solve this problem? The answer is—Yes, at a price.

Once a machine has been developed to perform an operation it can be made to repeat that operation as often as necessary. The duplicator produces many copies from one master stencil. The date stamp, once set, will stamp the same date until its setting is altered. The step-and-repeat camera will copy entries

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from a card file, which is easy to update, on to a film, which can be used to produce a bookform list or catalogue. The computer-controlled information retrieval system, once set to search for a combination of keywords, can check all the items in its memory files to see which of them tally with the required combination. Library accounting can be mechanized. Current awareness information can be distributed quickly to library users by computer-controlled Selective Dissemination of Information systems. Stock issue records can be made mechanically and used to print recall notices for overdue loans automatically. All jobs that involve no more than the faithful following of rules are likely candidates for mechanization. This leaves the interesting work to be done by people, but it also gives them the job of managing the machines.

Up to a few years ago, machines played only a small part in the activities of libraries, compared with the part played by people. The machines performed very simple functions and errors in their work were easily noticed and corrected. If the date stamp was not changed at the beginning of the day, this would (or should) be obvious the first time it was used. If a catalogue card contained a typing error this could be noticed by the person filing the card in the catalogue, and the card could be passed back for correction. The cataloguer could also recognize an author whose works appeared under slightly different forms of name. The dropping of an initial representing a forename, or the adding of a hyphen between last forename and surname, would not prevent the cataloguer from identifying the author and filing the items, after suitable editing, in an order likely to assist in retrieval later. It is very difficult to program machines to this kind of thing. Many current library activities are heavily dependent on constant maintenance by people, who are sometimes barely conscious that they are doing it. The feeling that something looks wrong, or oddly familiar, can help a librarian to right a situation before it develops into anything serious. This is the normal way of doing things, and people who are not alert all the time tend to be labelled stupid, and thought of as sources of chaos. Library managers try to recruit staff who are alert and who can be relied upon to work resourcefully, accurately and diligently with little supervision. If they succeed in this, managers can then plan procedures in broad terms and leave the staff to interpret, apply, and sometimes contravene them intelligently. Staff tend not to like procedures which spell out every minute detail of every routine and which must be followed strictly with no exceptions. When machines are used to carry out complicated routines, the manager's task is different. The machines will not argue, or have emotional problems, but they will have to be told everything in advance—i.e. will have to be programmed to cover all possible situations. They will do exactly what they are told—no more and no less. This may seem very simple and obvious, but some recent attempts to use machines in libraries and information centres have shown that managers find it difficult to think and work in this way and to persuade their staffs to help run efficient mechanized activities. Ineffective, badly planned dabbling is often followed by disillusion with mechanized methods and a return to conventional procedures. These problems are not peculiar to libraries. They have become pressing in every kind of human activity where machines are needed to tackle jobs which are uneconomic by conventional methods.

The systems approach

The systems approach has been developed to deal with these problems. Education in librarianship and information work is beginning to ensure that new entrants to the profession are aware of the principles of the systems approach. It will be some years, however, before these new arrivals become managers. In the meantime, much of the pioneering work will have to be done by managers who have had no formal training in the management of machine systems. Their attitude to the problems involved will have a crucial effect on the quality of the services offered to library and information service users in the near future. Several attitudes may be observed in current practice. One is to copy other people's methods, sometimes regardless of their suitability, as when small organizations adopt the methods evolved in larger units, including unnecessary complications. Another attitude, known as intuition or common-sense, is seldom accompanied by any sound analysis of the demands that the service is to meet. A logical approach may also be ineffective, unless the premises upon which it is based are in turn founded on an accurate knowledge of the requirements to be met.

Fortunately, the scientific method, which is the basis of the systems approach, is increasingly being used. Managers are finding that guesswork and rule of thumb mean wasted resources and frustrated clients. The scientific method has acquired rather a mystique, but for the present discussion it can be considered simply in six stages:

(*a*) Define the problem.
(*b*) State the objectives.
(*c*) Invent theories which appear to attain the objectives.
(*d*) Collect data which can be used to test the theories.
(*e*) Classify, analyse and interpret the data.
(*f*) Draw conclusions and generalize the theories if they appear to be sound. If they prove wrong, restate them or develop new ones and work through stages *d*, *e* and *f* again.

Using this method is no guarantee of arriving at a right, or best, answer to a problem. There may not even be a right or best answer. The virtue of the method lies in testing theories and intuitions against facts, rather than relying on untested intuition, and in discarding the theories which prove to be wrong. Indeed, the proving of a theory to be wrong is the only unchallengeable step in the method. But the theories that remain after testing are likely to be nearer to the best possible theories than those discarded. The scientific method can be adapted to the design of systems, including those investigated in organization and methods work. The names used for this kind of approach include systems design, systems analysis and systems engineering.

There are many definitions of system. One simple definition is *Parts working together to do something*. Examples of this are a hand holding a hooked pole to open a high window, or an electric water heating system with water supply, electricity supply, pipes, tank, heater, thermostat to regulate the temperature by regulating the electricity supply, a tap to draw off the water and someone to use the hot water.

Systems have parts going in (the input), parts which work on them and results coming out (the output). If a watch is kept on variations in the output, the information obtained can be used to alter the input, so as to make the system serve the user as the designer intended. In the second example, if the water in the tank is too hot, the thermostat turns the electricity off. If it is too cold, the electricity is turned on again. In an indexing department, if an indexer cannot analyse the subjects of a document, the departmental system could allow him to vary his procedure. He could ask other indexers, or the author if available, for help, rather than sitting idle. This referring back from variations in outputs to inputs is called feedback. It can be used to make systems self-correcting. If this ideal cannot be reached, any variation from normal working may be signalled to people who are authorized to deal with the situation which has arisen. Systems design methods vary a good deal, but thirteen steps usually appear during the development of a system.

(*a*) Define what the system is to do.
(*b*) Lay out the procedure in flow chart form.
(*c*) Make a preliminary system design.
(*d*) Determine the system requirements to meet the original definition of what the system is to do.
(*e*) Design the subsystems.
(*f*) Evaluate the new design.
(*g*) Plan the design and manufacture of systems equipment.
(*h*) Assess the improvements which would be gained by adopting the system.
(*i*) Revise the model.
(*j*) Test the model.
(*k*) Develop system specifications.
(*l*) Install, debug, modify and extend the system.
(*m*) Organize systems service to ensure maintenance to keep the system working.

These stages can be taken in more detail.

(*a*) *Define what the system is to do.* This is stated exactly, and in the most specific detail. Existing systems are examined to decide whether they can be improved or whether a new system is needed. Suppose that a system is intended to disseminate information to its users. An existing system disseminating documents or abstracts may not ensure that information actually reaches its users. They may fail to extract information from the documents. If this were so, a new system would have to be developed. If the number of users of a system was increasing, the extra traffic involved would be assessed to discover whether the system could stand the extra load. System constraints would be considered at each stage of the design. A *constraint* is anything that limits an objective of a system, such as the amount of money available, a time limit within which the system must be working, limitations of space or location, prejudice of users or managers, availability and competence of staff, the suitability of existing machines to do required jobs, or the existence of other large systems and their records which must be compatible with the new system.

(*b*) *Lay out the procedure in flowchart form.* If there is an existing procedure, the activities it involves are thoroughly examined to find out what is being done.

Sometimes this is not what existing written procedures say is being done, and not what the manager thinks is being done. There are several ways to find out the realities of the situation:

1 Direct observation of activities will show what usually happens, but may not reveal the methods used to cope with exceptional situations.
2 Interview and discussion with the staff operating the procedure will show what each is doing and what each thinks the rest are doing. Sometimes the most junior members of staff have most experience of system failures, and have profitable suggestions to make on improving the methods used.
3 A study of the records kept will help to show the kinds of items dealt with and how the staff deal with them. It will also suggest further questions to ask the staff in order to clear up misunderstandings and to discuss points forgotten or not raised in interviews.
4 Sampling techniques can help to determine how often certain situations arise. Staff may think that exceptions occur more frequently than they really do. Complex records may be kept to cover situations that it would be less expensive to ignore. For example, it may be cheaper to circulate non-confidential reports without a record system being used to chart their whereabouts and to enforce their return. Similarly it may be cheaper to present a photocopy of an item to an inquirer rather than to lend him the original document and then have to chase it later.
5 Written questionnaires to staff can produce a set of answers which are easily compared and analysed, but this method requires exceptional care in planning the questions. It also misses the chance which an interview gives to pursue a passing remark, thought unimportant by the member of staff being interviewed, but recognized as crucial by the investigator.

As each operation is examined, eight questions may be asked:

1 What is done?
2 How much is involved? How many times is it done?
3 Why is it done? What happens if it is not done?
4 Who does it? Could someone else do it better and cheaper?
5 Where is it done? Is this the right place?
6 When is it done? Is this the right time in the sequence of operations?
7 How is it done?
8 How much does it cost?

Every form used, or record made, may be similarly questioned.

Having determined what the existing system is doing, and having decided what any proposed system will have to do, the information collected is analysed and used in compiling a formal description of the procedure, including a cost analysis. The written procedure can then be used to compile a flowchart of the operations involved. There are many types of flowchart—several are illustrated in the Treasury's *The practice of O & M.*[11] The examples (Diagrams 1 and 2) give an idea of the appearance of one type. It might be thought that drawing a flowchart is unnecessary, if a formal written procedure has already been compiled. This is not so. Constructing the flowchart will bring to light flaws in an apparently full procedural description. Loose ends and gaps in the description become obvious as the work of charting proceeds. Wasteful activities, such as duplication of records, or the passing of materials between departments more often than is necessary, stand out when shown in diagram form. The discipline imposed by following the conventions of flowcharting itself encourages a systematic approach in the investigator. It also exposes the difference between the procedure as the managers and supervisors think of it and as it is really performed by the operators. Anyone who feels that the importance of flowcharts has been over-stressed above should try to draw one for any activity in his library. The chart should show all the operations performed, all the records handled and all the special actions called for in exceptional circumstances and emergencies. This exercise may help to convince him of their usefulness. If flowcharting is omitted, a new system, built on incomplete information and popular misconceptions, may be developed. It is unlikely to be a good one.

(*c*) *Make a preliminary system design.* Analysis of the old system will have suggested possible improvements. Each part of it was critically assessed. The following questions may be applied to the operations again, now that a complete picture of the procedure has been obtained.

1 Is each operation really needed? Can any be simplified?
2 Is the sequence of operations the best?
3 Could any operation be done better or more economically by someone else?
4 If an operation is changed, how will this affect other operations in the procedure?
5 What arrears of work are there? What interruptions or delays in the flow of work exist, and how can they be reduced? Do the clients have to wait?
6 Does information enter the system in an easy-to-use format? e.g. are forms well designed?
7 Do some operations cause bottlenecks which impede work flow?
8 Could any operations be done during waiting, or idle, time?
9 Can spot checks and calculated risks be substituted for any records kept as safeguards against exceptional situations? How many such exceptions occur, and how frequent are they?
10 What do the operators think about the procedure? Is staff morale good?

Redundant records may be abandoned. The flow of work through a department may be rationalized. Costly operations which achieve results less valuable than the efforts they involve may be stopped. A brief description now shows what is intended, and a flowchart of the main points can aid discussion between all the people concerned in the system design.

Five aims should be kept in mind by the designer. He should try to make the system:

1 *Simple.* Easily understood and worked. Complexity leads to confusion and errors.
2 *Flexible.* Adaptable to changing demands.
3 *Reliable.* It should fail safe and show departures from normal working in time for the staff to take action.
4 *Economic.*
5 *Acceptable* to users and operators.

He should work towards three ideals:

1 Skilled work by librarians or information men, when once done, should not have to be repeated by them.
2 Unskilled, repetitive tasks should be done by machines when this is economically feasible.
3 Each user of the library should receive a service adapted to his needs. It may be possible to copy or adapt a system devised elsewhere. This entails a careful comparison to see whether the requirements are met by this available system, or whether the requirements might be modified if the system comes very near to satisfying the demand which is to be met.

(*d*) *Determine the system requirements* to meet the original definition of what the system is to do. How many staff will be needed? How much space will be needed to allow the traffic generated by staff and users to move between stock, records, equipment and services? What sub-systems are needed?—e.g. a system involving the loan of stock will have a sub-system to control the recording of loans and a sub-system to chase items of stock not returned by borrowers. As this extra detail is built upon the framework of the preliminary system design the original definition of what the system is to do must be checked again. Will the proposed system do this? Has the investigation shaken the assumptions underlying that original definition? It may be necessary to scrap the original definition and start again.

(*e*) *Design the sub-systems.* The components, equipment and procedures must be designed so that each fits in with the others, e.g. the details of a catalogue entry could be arranged so as to be suitable also for use in a Recent Additions list, a Selective Dissemination of Information service, loan records and accounting records. Could the same master file be used to produce all the records required? Which jobs could be reduced to routines covered by procedures and delegated to clerks? Which jobs could be mechanized? Are staff capable of advanced work tied to clerical routines which frustrate them? Could part of their work be separated out and passed to clerks or machines? Which are the activities calling for genuine expertise which cannot be reduced to written procedures?—e.g. inquiry work with users unfamiliar with the system. Do the procedures state clearly who makes decisions and who bears the responsibility for the results of the decisions? If machines are to be introduced, should the old pattern of activity be adapted, or is an entirely new one needed? Obviously the answer will vary with the organization and its pattern of activities. Alternatives should be considered and costed. It is not always the obvious, common-sense answer that proves correct when a detailed, quantitative analysis is made. Sometimes the best solution for a sub-system is not the best answer for the system as a whole. There is little point in reducing the time needed to retrieve references from two hours to two minutes by using mechanized methods if it takes a week or more to obtain the documents referred to. It is wasteful to reduce binding costs by binding many issues of a periodical into one large volume if it is essential to lend the volume often to other libraries. Mail charges would soon exceed the binding savings.

(*f*) *Evaluate the new design.* Inconsistencies may have crept into the system design by the time all the detailed planning of sub-systems has been done.

They may be detected and removed by re-examining the system as a whole.

(*g*) *Plan the design and manufacture of systems equipment. Assess equipment costs and the training needed for operators.* It is very seldom that large machine systems will be specially designed for library activities. Development costs are so high that it may be better to adapt library methods to existing machines. The design of upper and lower case line printers for computer output illustrates this. Even though they were developed for bibliographical work, most libraries find it cheaper to use time on computers employed primarily for other work, although this entails using a printer with upper case characters only. Less expensive equipment is also needed in library systems. Well designed office layouts, desks and other furniture, fittings, forms and even rubber stamps can make significant savings in the cost of obtaining the results desired, by increasing the productivity of the people who work with them. Available mechanized systems should be examined to see whether they can replace manual methods, but the high standard of management which they demand should be borne in mind. Managers who have not instructed machines correctly to deal with all required situations will find that they can produce useless output just as fast as they produce correct results when conditions are normal. Machines may be inflexible in operation and difficult to adapt when a change in the system is required. They may entail a high initial capital outlay or a rental charge big in comparison with other library expenses. They may require skilled operators and maintenance by trained mechanics. All this can be very expensive, as can the cost of planning for their use, so they must be worked hard when installed to ensure that their cost is spread over a great deal of useful activity. Parkinson's Law can operate for machine systems, however, and the temptation to use the machines for useless activity should be resisted. Some managers, when served by a computer which can produce lists and statistical reports at the rate of more than a thousand lines a minute, forget to ask of each list and report: Is it useful? Do I need this information? Would a summary or a sample do instead? Can I act on it, even if I do get it?

Machines may become status symbols. A survey of computer installations in twenty-seven major companies in the United States in 1963 showed that eighteen of them did not pay their way. If the case for a machine seems promising after an unbiased appraisal, its characteristics must be analysed in detail. Suppose that a computer system is being examined, for example. Among the things to be checked are:

1. The size of its storage. How much data can be stored? How large and complex a program will it accept?
2. The speed of processing. How quickly can it do the jobs required?
3. In what form is information put into the system and received out again after processing? How fast?
4. Is it simple to program? Will the manufacturers help with programming problems?
5. How many programs relevant to library and information work are available already? Are they easily adaptable to the jobs required?
6. How often do similar machines already in use break down? How long does it take to repair them?

7 How long, and how often, will the machine be out of action for maintenance?
8 Does it need special accommodation, such as strengthened floors, or air conditioning?
9 How many specially trained people are needed to operate it?

Other machine systems may be similarly examined. Small organizations whose systems will be dependent on only one machine must be careful to plan procedures which will allow essential work to continue during breakdowns.

Equipment costs can readily be estimated. Staff training costs are more difficult to estimate. If changes are to be made, the people involved in the new system should be trained to operate it but, more important, they must feel convinced that the new system will perform better than the old one, that they will not suffer through the changes made and that they will be rewarded for any extra effort they are called upon to make. If they fear that mechanization may mean loss of status, or even loss of a job, they must be reassured, without deception. If redundancy is inevitable, fair treatment for those involved is essential. When change is contemplated, all the people affected must be fully informed, without delay, about the changes and the effects they are likely to have. If information is not made fully available, the grape-vine will function instead, and will put the worst construction upon every small piece of information let fall by management or the system designers. If the staff do not like the new system and do not feel that their problems as individuals have been sympathetically taken into account, they will tend to alter it or to use it ineffectively. This will cause it to fall short of full efficiency.

(*h*) *Assess the improvements which would be gained.* The costs of the proposed system should be estimated in detail. The improved services to be made available to users should be assessed, and the value of these improved services estimated. If the proposed changes would lead to a reduction in services to users, the cost of the inconvenience to users which this would involve should also be estimated.

(*i*) *Revise the model.* Check all the proposed procedures and the system descriptions as a whole once more to discover inconsistencies and omissions.

(*j*) *Test the model.* If any parts of the system can be described in mathematical terms they may be tested by using a mathematical model. This would be used to simulate the behaviour of the system in action, to see whether it could cope with expected situations, e.g. if many documents are distributed and irregular peak loads are expected, the system may be checked to see whether these peaks will lead to undue delays. If a small pilot project can be set up, this may be useful to try out equipment, forms and new methods to discover snags, to help train staff and to help win the support of the people involved. As each error in the system is put right, the effects of the correction must be checked, to ensure that it has not thrown other parts of the system awry.

(*k*) *Develop system specifications.* These are needed by people inside and outside the system. To avoid misunderstandings all terms used must be defined. Apparently trivial matters, like the difference between journals and other serials, or between books and pamphlets, can cause difficulties in communication. Cataloguing and indexing rules must be agreed. Machines, equipment and stationery specifications must be determined. These must be codified and made available to staff, users and suppliers of goods and services to the system. Libraries without agreed specifications tend to have inconsistent records and a jumble of unsuitable equipment and stationery. Their staff and users are unable, through misunderstandings, to make the best of the resources of the library or information department.

(*l*) *Install, debug, modify and extend the system.* The installation of the new system requires very careful planning. Before it comes into operation all the equipment must be ready, and the staff fully trained to operate it. If radical changes are made, as when manually maintained records are replaced by a computer-centred mechanized system, it may be advisable to run both the old and the new systems together for a time, until the new system has proved itself in action. During this time a close watch for snags is kept, so that any modifications needed may be made. It is important to distinguish between snags arising from the unfamiliarity of operators with the system, and bugs due to bad system planning. The pride of the designer in his system should not blind him to bugs due to his own errors. When the system has proved itself over a period it may be desirable to extend it to take in further activities, e.g a cataloguing service may serve additional departments. An information retrieval service may cover further material, serve more clients or offer a selective dissemination of information service.

(*m*) *Organize systems service* to ensure maintenance to keep the system working. Any machines used should have regular servicing so that breakdowns may be reduced to a minimum. Supplies of stationery should not be allowed to fall below agreed levels. Staff must be trained, and more than one person should be capable of doing each job, so that leave, sickness and staff changes will not result in crises. Periodically the system is reviewed. Demands change, and new systems, once they are in operation, should be regarded just as critically as the old systems they replaced. They were planned using the information available at the time of the investigation, and may not be the best for dealing with changed conditions.

As remarked earlier, the systems approach is not an infallible method of arriving at the best answer. It can be no better than the ability of the system planners allows, but it should help to avoid the introduction, or perpetuation, of bad systems.

It may well be said by a good many librarians and information workers that constant pressure of existing work makes it impossible to learn the principles involved in the planning of mechanization. How much should the librarian or information worker know about systems analysis? If he does not understand enough to talk to systems analysts in their own terms, and to realize when the analysts have failed to understand a library or information problem, he will not be able to communicate with the planning team, nor is he likely to be satisfied with his new mechanized system. How much should he know about computers and their programming? If he becomes interested, a good general knowledge will be useful, but those who do not grasp the principles will satisfy the data processing members of the planning team if they can state their requirements precisely and be willing to adapt their demands to the limitations imposed by available machines.

Busy librarians may also feel that the time to carry out a full systems approach to a problem, as described above, cannot be found either. This is unfortunately true in many organizations, and especially in those with small scale library or information services. Those faced with such a situation must decide whether to take a risk and to omit a thorough investigation—after all, intuition is not always wrong—or whether to base their pattern of activity on that of another organization with systems which have proved themselves to be simple, flexible, reliable, economical and acceptable in practice. In general, the blinder the leap forward, the greater the risk of failure. But whether the full systems approach can be made or not, the house should be put in order, systematically, before the machines come.

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COVILL, G. W. Librarian + Systems analyst = Teamwork? p. 99–101. (Discusses the difficulties arising when librarian and DP systems analyst work together in planning mechanized systems.)
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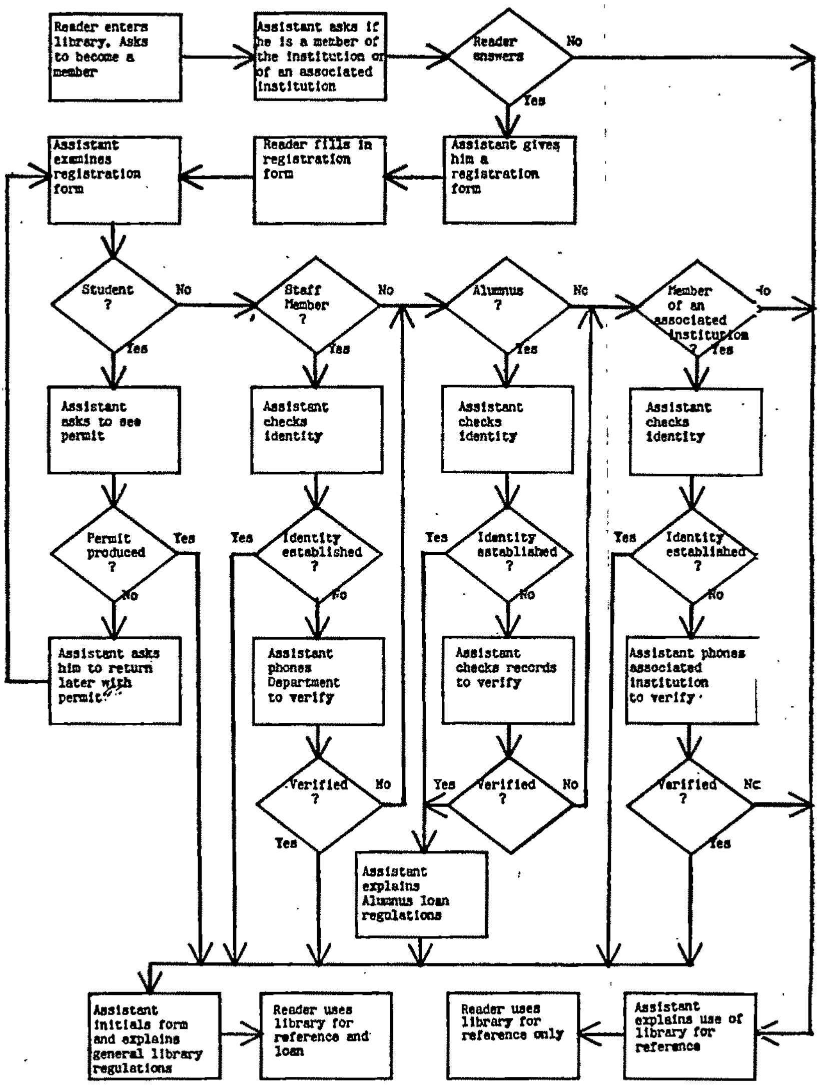
Diagram 1. The reader registration routine of an educational institution library. A flowchart.


Reader enters library. Asks to become a member
Assistant asks if he is a member of the institution or of an associated institution
Reader answers
No
Yes
Assistant gives him a registration form
Reader fills in registration form
Assistant examines registration form
Student ?
No
Yes
Staff Member ?
No
Yes
Alumnus ?
No
Yes
Member of an associated institution ?
No
Yes
Assistant asks to see permit
Assistant checks identity
Assistant checks identity
Assistant checks identity
Permit produced ?
Yes
No
Identity established ?
Yes
No
Identity established ?
Yes
No
Identity established ?
Yes
No
Assistant asks him to return later with permit
Assistant phones Department to verify
Assistant checks records to verify
Assistant phones associated institution to verify
Verified ?
No
Yes
Verified ?
Yes
No
Verified ?
No
Yes
Assistant explains Alumnus loan regulations
Assistant initials form and explains general library regulations
Reader uses library for reference and loan
Reader uses library for reference only
Assistant explains use of library for reference

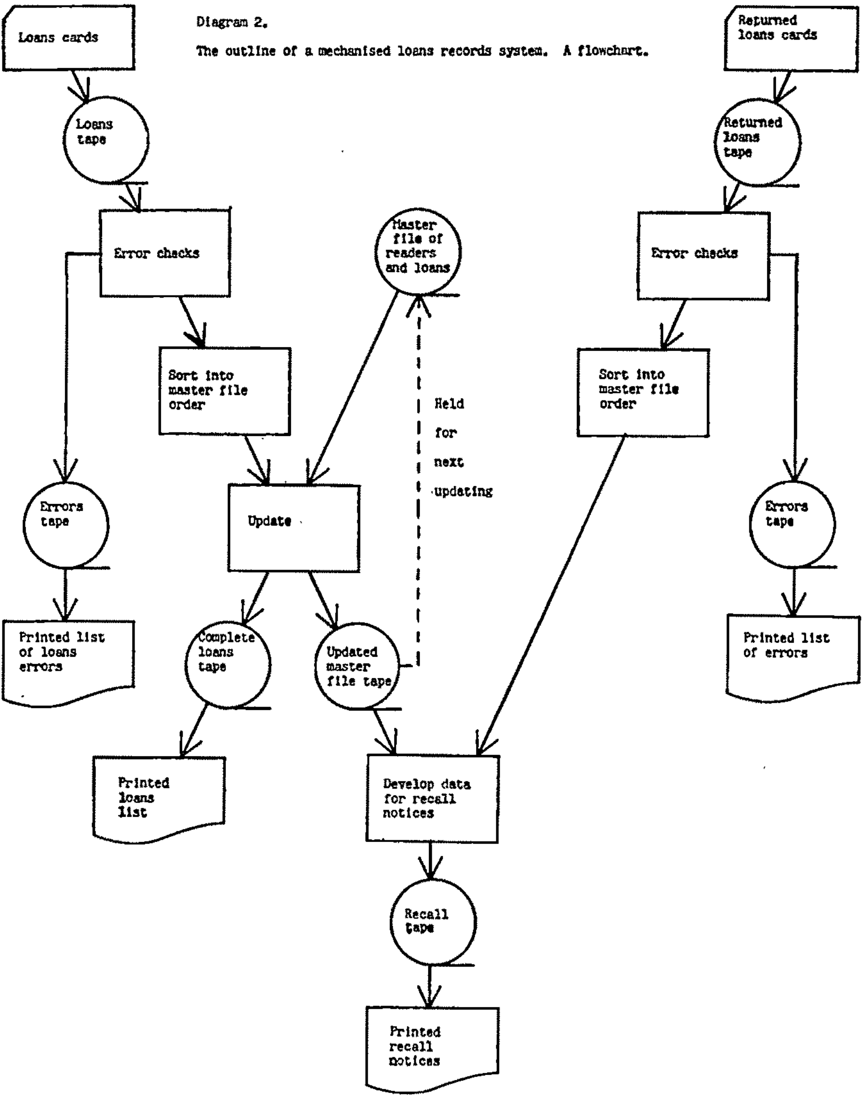


Diagram 2.

The outline of a mechanised loans records system. A flowchart.

A COMPUTER-ASSISTED FLEXIBLE INFORMATION RETRIEVAL SYSTEM

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Introduction

AS part of a policy of simplifying the indexing task in information retrieval, a system is being developed for using a computer to create indexes from a variety of styles of indexing. One of the main guiding principles in the design is ease of operation by people, both for indexing and retrieval.

A computer can offer freedom from inhibitions which have arisen from the requirements of traditional methods—many indexing rules and conventions are simply a way of being able to cope with a problem manually. One of the biggest advantages a computer can offer is that the mechanics or method of storing and searching the index can be considered separately from the indexing itself. But, in return for this freedom, the computer expects a more disciplined and rigorous method of working from the people involved with it.

The system, on which this paper is based, is comparatively simple and is still evolving; it attempts to select the things that people do well and the things that computers do well and to combine them to use the best abilities of both.

People are flexible. They have intuition. They can see meanings that are only implied in the words of the document and not expressed directly. They can call on a vast store of experience to understand a document, but unfortunately they do not have infallible memories for details and they are inclined to make mistakes. People are best suited to handling ideas rather than words.

On the other hand, computers are diligent, they keep on with the job, they don't get tired, they are accurate, they make very few mistakes; they are methodical, and they follow rigorously the procedures they are programmed to carry out. Unfortunately, this means that they are unimaginative and will follow a procedure even if it produces nonsense. Also, at the moment they do not have very large memories, at least compared with people. Computers are best suited to routine work and handling words and numbers, because they cannot cope with ideas.

Indexing

The indexing process which takes up so much effort by people can be thought of as being in two parts. First of all there is the decision, 'what is the essential part of the document?'; that is, which ideas have to be recorded in order to describe the document so that it can be found again when it is wanted? Secondly, there is recording this essence of the document in a consistent way. This is usually to convert the ideas to a classification-class or to a standard vocabulary; it includes making cross-references and similar tasks. This division of the indexing-task corresponds to the division between the abilities of people and computers; the first stage (condensing a large volume of data) is best handled by people with their flexibility and wide experience, but jobs of the second stage (being consistent and methodical) can be done by computers.

The easiest way for people to carry out the first stage is for them to look through the document or an abstract of it, selecting the essential part, and to mark the words of these ideas by simply underlining them, without any conversion to a standard vocabulary or classification. The underlined words can be punched into cards and fed to a computer for the second stage.

This method hinges on whether index terms chosen in this rapid way are useful for retrieving the right documents at the right time. It can be tested only by experiment, that is, indexing a collection of documents in different ways and finding out which relevant ones are recovered in answer to a set of test questions, and this has been done.

About one thousand of our internal reports were indexed by word-choosing and underlining. The underlined words, and any extra ones which the indexers felt ought to be included, were converted into an inverted index held on the magnetic disk storage of an IBM 1620 computer. Nine test questions were put to this index and also to two other indexes which are normally used to index reports. One of these was a punched-card index[1] which is based on indexing by concepts in the traditional way even though the mechanics of using punched cards may be non-traditional. The other index for comparison was a KWIC index: this was actually another low-indexer-effort index because it was based on marking the words in the title which were to become index terms, instead of the more common practice of giving the computer a list of trivial words which are to be ignored.

The outcome of this experiment was that indexing by information-scientists-underlining-words-from-reports gave as good a result as conventional indexing by concepts. Indexing from reports was somewhat better than indexing from the corresponding abstracts. Authors tended to be less successful than information scientists, although this is felt to be partly due to the large number of them and to their lack of training in selecting words. Further examination showed that the differences between the authors and information scientists, and between indexing from reports and indexing from abstracts were mostly in the number of marginally relevant documents found, and that, for highly relevant documents, all were little different from the concept-indexing of the punched card system.

The word-underlining indexes were better than the KWIC index, but there was little difference with the more relevant documents, which is as expected because they ought to have the right keywords in their titles.

The experiment showed that underlined words (selected natural language) can be used successfully for indexing, so a system is being evolved to cope with them. But, in doing so, the computer programs will also be able to cope with forms of indexing on which more effort has been spent, such as descriptors chosen from an authority list, or code numbers representing descriptors of structural fragments of organic chemicals. They will also be able to cope with some material which involves almost no skilled indexing effort, such as citations. A citation can be processed in exactly the same way as a descriptor, and searching for all documents with a given citation is exactly analogous to searching for those with a given descriptor.

Recording

One of the bugbears of introducing a new system is that of getting compatibility with the one or ones that went before it, and it is extremely common for the 'backlog' never to get into the current system. This may not be a bad thing if the data being handled has a short half-life, but the usual outcome is that an obsolescent system gets used less and less, because of the extra effort involved in repeating a search in the older material, and also because the people who are familiar with the older systems are retired, transferred, promoted or just forgetful.

Consequently, we have assumed that whatever system is being evolved now will be superseded by a better one in a few, or maybe many, years' time. Accordingly, each report is being indexed once-and-for-all and this indexing is recorded in machine-readable form so that it can be used on any system that might be adopted.

To operate on any data, the computer has to identify the kind of data it is handling, for example, whether it is a title, an author or a reference. Whereas a person can readily distinguish between these, it is a tedious process for the computer to do so unambiguously. It is far easier to insert appropriate identifiers in the input, and this also ensures that the machine-readable version can be readily converted to the input format of any system which may be used in the future. For historical reasons,[2] we are indicating the type of data by a mnemonic, punched at the beginning of each card(s), e.g.:

REF	reference
AUT	author
TIT	title
CIT	citation
ABS	abstract

The three letters give some redundancy for detecting mis-punching, and are easier to check visually than code-numbers.

The words *underlined* by our indexers, which are our descriptors, can appear in either the TIT or the ABS parts of the input. They are signalled to the computer by replacing the space before the first letter by an asterisk * and the space after the last letter by a currency symbol £. For example:

TIT *FLOCCULATION£STUDIES ON MODEL SYSTEMS
TIT *OCTADECANOL£AND*ARACHIDIC ACID£*SOLS£.

The * and £ signals could easily be removed whilst the records were being edited to the correct input format if we were ever to use a full-text system. The beginning and ending of a descriptor are marked so that phrases like 'electron microscope' can be treated as one, which simplifies searching. Usually, however, descriptors are single words.

It is unnecessary for the indexer to write out anything, except descriptors which he thinks should be included but which the author has not used. Good keypunch operators can work from the documents themselves provided that they are clearly marked up, and the format of the cards that they are punching is reasonably simple.

Searching

The needs of an inquirer for access to the index can be satisfied on most occasions by one or both of two approaches. One is for a rapid answer, which need not be complete, to a question which can be stated in a few not-too-common terms. This is best fulfilled through a printed index. The other is for searches which cannot be expressed so simply, or for comprehensive ones, and for which the answer is needed not immediately but within twenty-four hours. This is best fulfilled through a search by the computer of an index stored on magnetic disk or tape. If a quick answer is required to a comprehensive or complex question, the printed index can be consulted at once to give enough answer for the inquirer to start reading. The full answer should be ready before he has assimilated the partial one from the printed index.

In both approaches an inquirer can frame his question better if he knows what descriptors have been used in the index, particularly those which are similar in meaning to the ones he thought of. Our experimental searchers did much better with both selected-natural-language and KWIC indexes when they had a list of the words which had been selected by the indexers. However, we found that it takes two to three hours to look through a list of about nine thousand descriptors. This is much too long for general use, and so shorter, more structured lists are now used in the form of a thesaurus. The relations between words which are listed in it are derived intellectually but the file is maintained and printed out on the computer, which also inserts the reverse entries corresponding to the ones entered. This thesaurus gives more flexibility than a conventional classification, because it is not tied to a single tree structure and a descriptor can have more than one general class. Also it is possible for descriptors to be related to each other without being in a generic/specific relationship. The thesaurus is not intended as a complete logical breakdown of knowledge but as a practical guide to people preparing questions, and it needs only to include descriptors used in the index.

To keep the thesaurus up to date, any new descriptor in the printed index is signalled by the computer to the index organizer so that he can consider how it ought to go into the thesaurus. The comparison can also be arranged to signal separately new words of the same root as existing ones.

The form of printed index which we have chosen is a variant of KWIC, in which the descriptor is printed as a heading at the left of the page followed by the full titles and references of documents for which it was chosen in the title. This index, commonly called KWAC (Key Word And Context) or KWOC (Key Word Out of Context), is slightly more difficult to program than KWIC, but is easier to use. This KWAC index is preferred to a dual dictionary type because the searcher can sift-out the documents he wants to see by looking at the titles, instead of having to refer to a separate list. Incidentally, one of the features of the punched-card index which we will be sorry to lose is that the product of a search is abstracts of the answers; the titles are partial compensation for this.

The computer programs that are used for the KWAC index are also used to print-out a citation index, simply through an editing program which converts the citations into the form in which descriptors normally appear. This index, being derived independently of subject indexing, will enable the searcher to amplify his answer, and it involves no extra skilled indexing effort to produce. Other indexes derived independently could also serve to amplify searches, and would give a gain in retrieval with much less effort than making the subject indexing more exhaustive.

This is as far as the system has evolved. Computer-based searching has not yet been developed, although indexing for it is going on. From our experiment we have developed a specification of what a computer-based system ought to do. We are waiting now to see what programming packages the computer manufacturers are going to release. From a watch on any difficulties that arise in using the printed index, we expect to be better able to judge what features of computer searching are necessary.

Discussion and Comment

In the same way that the KWAC program might be used for a citation index, other parts of the mechanics can be used in different ways. In the form of input, the mnemonic serves to tell the computer how to handle the particular piece of data. It is possible to 'cheat' the computer and cause it to handle data as though it were another kind. For example, the data indicated by TIT may not be the actual title, but could be a synthetic one which may not even be grammatical, but simply a string of descriptors or even of code numbers, as the index organizer wishes. Similarly the ABS data may not be an abstract but only a string of descriptors, or indeed any words or symbols which are not wanted in the printed index (which are based on TIT data), but need to be recorded for computer-based searches or other purposes.

The mechanics of indexing, storing and retrieving are now almost independent of the form of the actual indexing data. This is one of the principal benefits we can get from the use of the computer. Other techniques of mechanization such as machine-sorted punched cards or peek-a-boo cards, whilst being very useful, on the whole impose limitations on the indexing that they can be used with, e.g. maximum number of terms in authority list, generic posting and searching. The limitations of the computer are small by comparison, and make it possible to divorce the mechanics from the indexing. Although concentrated on reducing indexer effort, the mechanics being developed are not restricted to selected natural language, but can cope with index terms chosen by more indexer effort from an authority list, either as words or as code numbers.

Throughout, the aim is to use the computer to do jobs that are tedious to do manually, and to give the indexers freedom to choose the words which express the ideas of the documents most closely. The objective is to produce not a perfect indexing and searching system, but one that achieves a balance between recovery of relevant documents, ease of use, and investment in programming effort. There is a danger that computers may be misused and operations carried out on them 'because they can be done' rather than because they are necessary. This we are trying to avoid.

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DISCUSSION

Mr T. Whitehall (Brooke Bond Research Laboratory) asked what the purpose was of comments, which were obviously not scope-notes, in the searching thesaurus.

Mr Shaw replied that notes such as those illustrated, or scope-notes, could be inserted into the thesaurus wherever they would be of help to a searcher. They were punched and processed as though they were relationships, this being another example of the flexible approach used.

Mr E. B. Jackson (IBM) said that the current tendency towards consortia would seem to make it possible for small information services to combine with similar organizations in their subject fields or in their geographic areas thus reaching a 'critical size' for implementation of mechanization. Secondly, in addition to the costs of mechanization, the professional advantages of accomplishing detailed, prompt service (that we have insufficient professional staff to accomplish otherwise) must be considered. The profession could not hope to get enough staff to do all the tasks it was obliged to perform to an acceptable standard of excellence.

The Chairman pointed out that it was difficult to achieve compatibility in information handling systems, even between organizations in the same industry. No one had mentioned the possibility of arranging consortia for the sole purpose of providing hardware and machine services, e.g. programming, leaving the individual organization to look after the intellectual side of its own requirements. The use of data links with a central computing facility might thus provide all the services at an acceptable cost, whilst still permitting each organization to control its information in the way which best suited it.

Mr B. C. Vickery (Aslib) asked whether the small information unit might find it valuable to use machine methods, even though throughput was relatively small, if their intensity of exploitation was high (e.g. by deep indexing).

Mr Simpson replied that much would depend on one's aim. The small unit would have to buy expert services from outside, otherwise it would be overtaxed. It would have to learn how to use outside experts to fulfil well-defined requirements.

Mr C. W. Cleverdon (College of Aeronautics, Cranfield) asked how many descriptors were used in indexing each document and how many additional descriptors (i.e. those not occurring in the document). Had Mr Shaw considered eliminating the indexer and allowing card-punch operators to select terms for the title and abstract?

Mr Shaw replied that the average number of descriptors for each document was about fourteen, of which only an average of 0.16 descriptors per document were additional. Information scientists were the most efficient at this task, followed by authors and then card-punch operators. The differences between these three groups were statistically significant.

SELECTIVE DISSEMINATION OF INFORMATION USING A KDF9 COMPUTER

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Introduction

MANY libraries in research organizations and in industry operate current awareness services of one kind or another, ranging from the circulation of copies of periodicals to the publication of information bulletins and the personal notification of items of interest to individuals. In the latter case the subject interests of users are recorded and the information staff, when scanning the incoming literature, use these records to match users' interests to documentary input.

Clearly there are limitations to such a system. When the number of users per information officer exceeds a certain value it becomes impossible for the latter to consult his card file every time he scans a new article or report; instead he tends to carry in his head the interests of as many users as he can, checking the file only occasionally, and those who impinge most frequently upon his consciousness get the best service. The optimum number of users per information officer will depend on the nature of the subject field, the variations between users and the skill and experience of the information staff, but it is certainly less than one hundred and could be as low as twenty or thirty.

To provide an effective service, when the ratio is higher than this, is beyond the capabilities of a purely manual system. What is required is some method of automatically matching users' requirements to documentary input in such a way that little of importance is missed and noise can be easily eliminated by rapid manual scanning of the output.

Culham Information Services

The Culham Library has provided a current awareness service since its inception in 1961, but after three years' operation the service was beginning to run into some of the difficulties described above. The Laboratory has a staff of nearly eight hundred of whom about 350 are potential library users and of whom three hundred or so might at some time or other require a selective dissemination of information. The library staff totals eight of whom only two are information staff.

The Library subscribes to over six hundred journals of which about half may yield material suitable for dissemination. In addition over 1,300 report titles, seven hundred books and 250 pamphlets are added each year. All books, reports and pamphlets, together with those journal articles considered to be of general interest, are listed in the weekly Library Bulletin. Such listing does not preclude the sending of notifications to individuals for such items.

With the arrival on site of a large computer, an English Electric KDF9, it was felt that an effort should be made to use this machine to provide the automatic matching described above, and in 1965 experiments were conducted to test the feasibility of such a procedure. Several experimental SDI systems using computers have been described,[1, 2] most of which envisage the necessity for elaborate indexing techniques using key-words, thesauri, etc. The Culham system had to be tailored to an existing situation with the following limitation:

1 An information staff of two only with some assistance from typing and library staff.
2 No additional effort to be expended on putting material into the system; i.e. the minimum of processing before presentation to the computer.
3 No interruption in existing services.
4 No reduction in either the content or quality of presentation of the Library Bulletin since this is sent to a large number of individuals and organizations outside the Laboratory.

With these restrictions it was apparent that any scheme using a formal indexing language would be inappropriate. The system had to save the time of the existing staff and increase the efficiency of the dissemination process with the minimum involvement of other staff. Only those 'handles' such as author, title, report number, etc., which can be recorded by a typist during a normal input process would be acceptable as retrieval media. It was encouraging to know that such a philosophy had already been adopted, though for different reasons, in the TIP retrieval system at MIT.[3]

One method of reducing input effort is to use other people's input in the form of magnetic tape. This is the method adopted by the Ames Laboratory[4] which uses tape supplied by NSA and *Science Citation Index*, and by AWRE, Aldermaston[5] using *Chemical Titles* tapes and 'package' programs. However, no organization was known which could supply input tapes covering the interests of the Culham Laboratory (plasma physics, controlled fusion research, astrophysics, superconductors, ultra-high vacuum technology, etc.) with a minimum of extraneous material and in the end it was decided to use only titles as input to the system and to match on these alone with the proviso that additional descriptors could be added in the small number of cases in which titles appeared to be inadequate.

After a short experimental period which showed that reasonably high recall and precision ratios could be obtained from title matching, the system became operational in April, 1966.

Operation of the SDI system

The KDF9 computer is programmed to match the current input of information, in the form of journal articles and reports to the subject interests of individual users, the matching being achieved by a comparison of words or groups of words in each user's profile with words in the titles of articles and reports. At the same time the computer extracts and arranges items of general interest for the *Library Bulletin*.

Profiling

The compilation of the profiles—the word list associated with each subject interest of the user—is the most time-consuming part of the operation, but once done, need not be repeated within a significant period of time; occasional up-dating or modification is all that is required. The profile defines the major and ancillary subject interests of the user and is compiled in the form of a matrix in which terms are grouped according to the user's requirements. The layout of a typical matrix is shown in Fig. 1.

Ten columns are available, each with thirty rows and each element accommodating one word which consists of up to seven characters preceded by an identifier, coinciding with a KDF9 word length of forty-eight binary digits or eight characters. The last column is reserved for authors so that users can obtain papers by particular authors whether or not they deal with named interests.

In each of the first nine columns the thirty rows are subdivided into six groups of words. In the first group are words defining the main interest; these are termed 'major' words and at least one of these must be found in the title of a document for it to be considered at all. If more than five 'major' words are required other columns can be used and many matrices may be allowed for one user. The largest profile so far compiled covers nine columns, the smallest one column.

The remaining five groups of so-called 'minor' words in each column can be linked with the major word group in a variety of modes, each defined by a prefixed identifier. The modes represent variations in co-ordination level and are:

1 *Normal mode,* in which the concept is defined by a pair of words, one drawn from Group 1 and one from any other group.

2 *Diagnostic mode,* defined as above except that if a major word from Group 1 is matched but no qualifying minor word is found in the title, then a diagnostic print-out is obtained showing the partially linked items.

3 *Linked mode,* where the concept is defined by a combination of words from Group 1, linked groups identified by an asterisk, and one or more other groups. One word is matched from each group.

4 *Linked mode with diagnostic output,* defined as above but, if only a partial match is obtained, a diagnostic print-out occurs.

5 *Non-select mode,* in which a group is assigned a marker 'N' so that any match of a Group 1 word with a word from the 'N' group excludes that item from capture.

6 *Selective mode,* to enable matching to be made from a selection of groups of synonyms. If n (where $n < 6$) groups of words are chosen from the six available, a capture is made if any n are matched and a diagnostic print-out obtained if any n—1 are matched.

Examples of the modes are shown in Fig. 2. The profile information is transferred on to punched cards from which a magnetic tape is prepared and added to as further profiles are fed into the system.

Input

(*a*) *Journal Articles*

Every journal scanned is given a code number and these, together with the journal titles (see Fig. 3), are transferred to magnetic tape. A six figure code number is used to allow for interpolations since the code number sequence also defines the alphabetical sequence of journal titles. Thereafter only the code number is needed at the input stage for the full title to be read out for each journal reference in the output.

Each incoming journal is scanned and individual articles marked on the journal title page using 'B' to denote inclusion in the Bulletin and 'X' to denote items of specific interest to individuals. Either daily, or at any convenient time, these items are recorded on paper tape. The hard copy prepared at the same time (Fig. 4) is used for checking purposes.

(*b*) *Reports*

In general report titles are less explicit than those of journal articles so that additional descriptors have to be used in most cases. Many reports (e.g. progress reports) cover more than one subject theme so that partitioning is necessary at the input stage; in addition some reports are not publicly available and cannot be listed in the *Library Bulletin*. For these, and other reasons, reports were excluded from the computer system during the first ten months of operation to give the operators a chance to get the programmes running smoothly before introducing further complications.

All incoming reports are scanned and descriptors allocated where this is felt to be necessary. To simplify programming and final print-out, the number of descriptors per report is limited in such a way that the total number of characters (letters and spaces between words) does not exceed eighty. Descriptors are allocated mainly from terms occurring in the 'glossary of major words' produced by the computer program from the users' profiles, since these are the only terms necessary to ensure a match or partial match. The extra input time required for this operation is about one minute per report, on average, and is justified by the increase in the probability of capture which results. Since most reports are received in the Laboratory as a result of exchange arrangements with other laboratories working in the same field, the mere fact that a report has been received indicates that there is a high probability that it will be of interest to someone in the Laboratory and so the usage factor should approach 100 per cent.

Since the *Library Bulletin* acts as an accessions list as well as an information bulletin, all report titles are listed so that it is not necessary to distinguish between Bulletin and non-Bulletin items as in the case of journal articles. However it is necessary to distinguish between unclassified material which is publicly available and classified material which is not. At the scanning stage the former are marked with a 'B' and the latter, which have to be listed separately, with a 'Y'. Once a week the reports are sorted into serial number order and entries prepared on the tape typewriter (Fig. 5).

After checking and correcting the tape is used first as input to the computer for the SDI matching, and then as input to the tape typewriter to prepare the reports section of the Bulletin.

The Computer Program

As described above, magnetic tapes are prepared from the users' profiles and from the list of journal titles. An auxiliary program compiles a 'major word thesaurus' from the major words occurring in the profiles and this too is stored on tape. Before any processing can begin this magnetic tape file is read into the computer which is then ready for the eight-hole paper tape containing the information input. This is read directly into the main memory of the computer and becomes part of a series of 'data blocks' (see Fig. 6).

The first part of the program reads the journal heading statement into section (i) and the item content into section (v) and then extracts authors' names and keywords. The latter are defined as all words in the title of a non-trivial nature (i.e. excluding 'and', 'or', 'the', etc.) and are stored to a length of seven characters in section (iii) apart from some special 'composite' words which are segmented to be stored as double words.

The program then compares these keywords with the 'major word thesaurus' and puts any major words found into section (ii). Both keyword sections ((ii) and (iii)) are then sorted into alphabetic order.

A more detailed description of the computer program is contained in Appendix 2.

Output

The computer systematically matches words in the data blocks with those in successive users' profiles, subject to the constraints of each profile matrix as described above. The matching is carried out in three stages (Fig. 7):

(*a*) Authors' names; (*b*) Major words; (*c*) Minor words.

Author matching is a straightforward comparison on a yes-no basis. Keyword scanning is in two parts; first a preliminary scan matching major words with the top row of each matrix and, secondly, a more detailed scan when a partial link has been established. As all words are in alphabetical order the actual scanning time is considerably reduced. The results of the matching, for each profile, are transferred onto magnetic tape as the scan proceeds and from this a line-printer output is obtained with details of every item captured for each individual. A typical output is shown in Fig. 8. During the matching the information input is transferred to magnetic tape where it is cumulated to be used as an information store for subsequent use for retrospective retrieval.

Dissemination

The SDI print-out is scanned by the information staff who check that each item appears to be within the scope of the recorded profile and follow up any diagnostic print-out which may indicate the need for profile modification. The captured items are then sent to the individual users who are asked to judge the relevance in each case. From the answers, statistics relating to overall performance are obtained.

Those journal items intended for inclusion in the Bulletin are sorted in the computer and read out each week onto paper tape in alphabetical order of journal title. The tape is then put through the tape typewriter to produce that part of the Bulletin relating to journal articles (see Fig. 9).

Analysis of the system

In the twelve months from May 1966 to April 1967 approximately 3,700 journal articles were fed into the system of which 2,400 were selected for wide dissemination in the Bulletin and 2,500 were captured for selective dissemination to individuals. The total number of notifications was 7,500 (since some items went to more than one person).

At the end of this period about one hundred profiles had been prepared and taped. Line printer output for SDI is obtained twice a week and Bulletin output once a week, the average processing time on the computer being thirty-five minutes per week.

Usage

The percentage of input items selected by the computer for dissemination naturally increases as the number of users grows (Table 1):

TABLE 1

Journal Articles Only

Period May 1966 – April 1967	Average no. of users	Average number of items per week		Per cent Selected
		Fed In	Selected	
1st quarter	45	72	42	60%
2nd quarter	65	74	50	67%
3rd quarter	70	66	46	69%
4th quarter	90	64	53	83%

This tendency for any increase in total usage to be rapidly reflected in a reduction of input effort per useful item disseminated is one of the attractive features of SDI systems, provided of course that a reasonable precision ratio is maintained.

A more detailed picture of the selection mechanism can be obtained from Tables 2 and 3 which show the input and output for two weeks selected at random during a period when the number of profiles in the system was eighty-four.

From Table 2 it can be seen that the number of unproductive items put into the system in any week is very small (between 3 and 6 per cent) and, of course, some of these may later be selected during a retrospective search. Table 3 shows that in an average week at least three-quarters of the users will receive something from the system and between a quarter and a third will receive five or more references.

TABLE 2

Selection of Journal Articles

x = number of times a particular article was selected for SDI
y = number of articles selected x times.

WEEK 1 *Total input* 64 *articles*

x	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
y	16	8	8	10	3	3	6	0	2	3	1	2	1	0	0	1

(of the sixteen articles not selected for SDI, eleven were selected for wide dissemination in the Bulletin)

WEEK 2 *Total input* 83 *articles*

x	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
y	11	15	7	10	7	7	6	2	5	4	4	2	1	0	[illegible]	1

(of the eleven articles not selected for SDI, eight were selected for wide dissemination in the Bulletin)

TABLE 3

Dissemination to Users

p = number of notifications received by a user
q = number of users receiving p notifications

WEEK 1 *Number of users* = 84. *Number of articles processed* = 64

p	0	1	2	3	4	5	6	7	8	9	10	11	12
q	19	21	12	7	4	6	2	6	3	2	1	1	0

WEEK 2 *Number of users* = 84. *Number of articles processed* = 83

p	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
q	18	15	12	7	3	5	5	1	3	2	1	2	2	1	1	2	0	2	0	1	1

Precision

The individual precision ratio can vary considerably because of the wide variations in co-ordination level specified by users when the profiles are compiled. To measure this, feedback from users was obtained on a sample basis, each user being asked to state the degree of relevance of each item notified, as follows:

(*a*) relevant to subject interest
(*b*) of interest but not directly relevant
(*c*) irrelevant.

In the case of relevant references, users were also asked to say if they were aware of the item prior to receiving the notification.

For any sample period statistics are obtained for each computer run as shown in Fig. 10. Analysis of these results indicate an average precision ratio in the region of 90 per cent, taking the figures for both (*a*) and (*b*) above in calculating the rate, or 85 per cent if only (*a*) is taken. The definitions of relevance may, of course, be criticised on theoretical grounds; they are not very precise and they rely on subjective judgements. Nevertheless from a purely practical view, in an operational as distinct from an experimental situation, user satisfaction would appear to be the most useful basis on which to judge relevance.[6]

It should be noted that the ratio is calculated as a percentage of the notifications actually sent to users, *after* the information officer has scanned the machine output. In practice the number of items deleted as a result of this scan is too small to have any significant effect on the results.

Recall

Recall was tested by sending users lists of the total weekly input and asking them to mark up:

(*a*) Items they considered relevant of which they had not been notified

(*b*) Items which appeared irrelevant, but which had been notified.

The replies were compared with the selections actually sent out, and details of the results are shown in table 4.

TABLE 4

	Titles	Relevant titles received	Relevant titles in system	Irrelevant titles received	Recall ratio %	Precision ratio %
Journal articles	266	247	323	19	76	92
Report titles	46	37	66	9	56	80

Because of the effort involved, both to Library staff and the scientists concerned, questionnaires were sent out on a sample basis. About thirty were sent each week, over a period of seven weeks, moving through the list of users in rotation.

233 questionnaires were sent out, and ninety-seven replies were received in the period considered. These ninety-seven contained notification of 266 journal items and forty-six report items.

The recall ratio is defined as: $\dfrac{\text{No. of relevant titles notified}}{\text{No. of relevant titles in the system}}$

and the precision ratio as: $\dfrac{\text{No. of relevant titles received}}{\text{Total no. of titles received.}}$

The analysis will continue on a sample basis, and is being extended to selected users outside the Laboratory, in the United Kingdom and overseas.

Timeliness

The speed with which information is disseminated appears to be satisfactory in that only about 6 per cent of the relevant references were already known to users at the time the notifications were received.

Cost

The input to the computer-based system includes journal articles, reports, books, etc.; the output includes individual notifications, an information bulletin which is also an accessions list, a quick reference keyword index for use of the information staff and may later include catalogue entries, bibliographies and a retrospective retrieval service. It would be neither practical nor helpful to try to compare the whole computer-based system with all the separate manual procedures which preceded it because in many cases there is no exact correspondence between the parameters being measured.

Instead a comparison has been made for one particular area, i.e. the processing of journal articles only to provide wide dissemination in the Bulletin and selected dissemination to individuals. The details are given in Appendix I. Limiting the analysis to this one area enables a simple comparison to be made between the two systems and shows that the overall costs are of the same order in both cases. Using the computer, however, not only results in a saving of man power (mainly in the professional grades where saving is most desirable) but enables a far better service to be given to users (e.g. more users can be given a service in greater depth and all users stand an equal chance of receiving relevant material).

Equipment

Input for the first twelve months of operation was processed on a Frieden Flexowriter but this machine has now been replaced by an Ultronic 811 which has a number of additional facilities.

The computer is an English Electric-Leo-Marconi KDF9 with a random access disc file of about four million words (one word = eight alpha-numeric characters), a core store of thirty-two thousand words and magnetic tape files of about two million words per reel. Input facilities are from punched cards, paper tape, or magnetic tape and output can be to a line printer, with a printing speed of one thousand lines per minute (140 characters per line), or punched paper tape at a rate of about one hundred characters per second.

Further developments

The Laboratory has received a grant from the Office of Scientific and Technical Information of DES to develop the system in two directions over an experimental period of two years from 1st March 1967. The objects of the project are:

(*a*) To extend the SDI service to plasma physicists and other scientists who are working in this field in laboratories elsewhere in the United Kingdom and in other countries.

(*b*) To design a system for the retrospective retrieval of information in response to specific questions using the SDI input already stored in the computer, the latter being used on-line through remote consoles.

Extension of the SDI system

The purpose of the first experiment is to discover whether a computer-aided dissemination system, designed primarily to serve a group of workers whose interests and backgrounds are well-known to the information staff, can be equally effective in providing a service to external users working in different environment remote from the information centre.

It is hoped to obtain the co-operation of up to one hundred external users for the experiment and the results will be compared with those from the internal system.

Multi-access Real Time System for Retrospective Retrieval

In many scientific and technical fields it is desirable that the user should have direct access to the information retrieval system so that he can carry out his own searches when necessary and not be forced to work through an intermediary. This requirement is met in many conventional manual systems, but rarely in sophisticated mechanized systems, most of which use complex indexing languages not readily understood by the user. In addition most of these systems employ batch processing and the continuous feedback available to the reader in a real time system is absent.

The experiment has two main objects:

1 to test the effectiveness of a computer-based *retrospective* retrieval system using mainly title input, and

2 to design and test programmes for operating such a system on-line, in real time.

The first part will require the preparation of a series of 'profiles' representing questions which might be asked and to which an answer is known to be contained in the system. These profiles can be prepared at various co-ordination levels and the results compared. Guidance on the synonyms, generic terms, etc., to be used will be provided by a thesaurus compiled for the purpose.

The second part presents two main problems, namely:

(*a*) the extent to which users will need guidance with the intellectual aspects of the system—i.e. what do they need to know in order to prepare efficient profiles for processing their own questions and how can these profiles be modified to improve performance, and

(*b*) the extent to which sophistication in programming can improve performance.

To test the first problem the same questions will need to be processed by both user and the project staff, after a modus operandi has been agreed upon, and the profiles and results compared. The second problem hinges upon the possibility of designing programmes which allow the user to modify his original profile as the search proceeds in real time.

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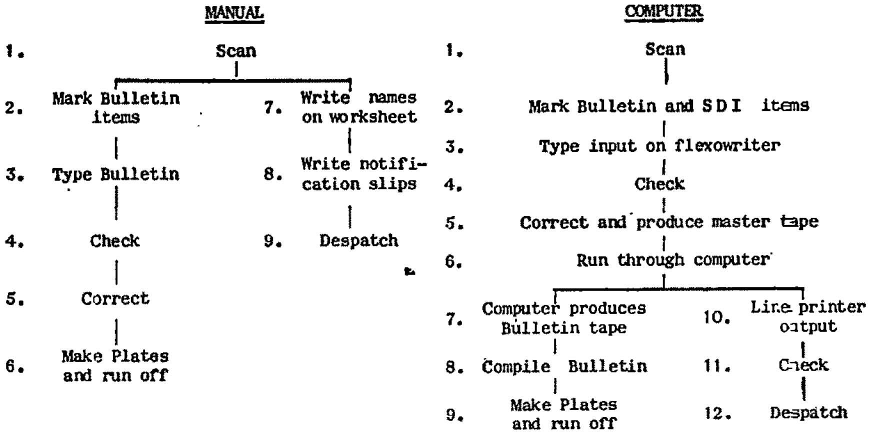
APPENDIX I

COMPARISON OF MANUAL AND COMPUTER SYSTEM

(journal articles only)

A. *Step-by-Step Analysis*


MANUAL
1. Scan
2. Mark Bulletin items
3. Type Bulletin
4. Check
5. Correct
6. Make Plates and run off
7. Write names on worksheet
8. Write notification slips
9. Despatch
COMPUTER
1. Scan
2. Mark Bulletin and SDI items
3. Type input on flexowriter
4. Check
5. Correct and produce master tape
6. Run through computer
7. Computer produces Bulletin tape
8. Compile Bulletin
9. Make Plates and run off
10. Line printer output
11. Check
12. Despatch

In each case the left-hand part of the fork indicates Bulletin compilation and the right-hand refers to SDI. Items 6 and 9 of the manual system, and 9 and 12 of the computer system are common and are not included in the analysis.

B. *Annual Throughput*

Of the six hundred or so journals taken, about 280–300 produce items for Bulletin and SDI. In the twelve months, May 1966–April 1967, 3,675 items were marked of which 2,415 were Bulletin items. 2,454 items were selected by the computer for SDI resulting in the sending out of 7,446 notifications.

C. *Comparison of Effort to deal with the Volume of Work Defined in* 'B'

Note.—A. indicates professional grade man hours.
B. indicates man hours at typist or clerical level.

MANUAL SYSTEM		*Man-hours*
1. Scan, mark items, write names on worksheet	(A)	1400
2. Type Bulletin	(B)	160 (2415 items)
3. Proofread	(A)	20 (2415 items)
4. Correct Copy	(B)	25 (2415 items)
5. Write notification slips	(B)	500 (7446 items)

COMPUTER SYSTEM		*Man-hours*
1. Scan, mark items	(A)	440
2. Type input	(B)	180 (3675 items)
3. Proofread	(A)	30 (3675 items)
4. Correct tape	(B)	30 (3675 items)
5. Computer processing		30 Computer hours
6. Compile Bulletin	(B)	60 (2415 items)
7. SDI Check	(A)	25 (7446 items)

D. *Summary of Effort Required*

MANUAL SYSTEM	COMPUTER SYSTEM
A. man hours = 1,420	A. man hours = 495
B. man hours = 685	B. man hours = 270

Assuming that the A salary rate is roughly twice the B rate and taking one man hour at the B rate as a unit:

MANUAL SYSTEM	COMPUTER SYSTEM
3525 units	1260 units

Difference = 2265 units

Against the saving of 2265 units must be put the cost of computer time. The full rate for costing computer time is about £85 per hour (for a two shift system) which includes maintenance, overheads, depreciation, etc. If this rate is used then, for comparison, the full rate of employing a person should be used to calculate savings in man-power. In a research establishment a conservative estimate for this would be 2¼ × salary.

Assuming that the average B unit is nine shillings, then:

Cost of effort saved = 2265 × 2¼ × 9/– = £2,290
Cost of computer = 30 × £85 = £2,550

APPENDIX II

THE COMPUTER PROGRAMS

(by D. H. Carpenter)

Note.—The system was developed on an Egdon KDF9 computer with maximum configuration. Considerable use has been made of the advanced features of the Egdon system, in particular, dynamic allocation of core storage and the use of a disc file for primary backing store. (Approximately 2M of disc storage is available for the user program.)

The present system is composed of a suite of three programs whose functions are outlined below.

(i) MAGFILE—prepares a master record on magnetic tape of the following data:

- (*a*) User profiles (read from cards or a permanent file on disc);
- (*b*) Major word glossary (extracted by program from (*a*));
- (*c*) Complete list of journal titles (read from paper tape to preserve character set for Bulletin output).

Facilities have been included to allow continuous updating of the records without repetitive loading of the bulk data.

(ii) BULLMAKER—reads selected items from paper tape and extracts those designated for the weekly bulletin. The appropriate journal titles are added for the master tape, the items sorted alphabetically, and the compiled bulletin is punched on paper tape from which copy is made for printing.

(iii) DISSEMINATOR—comprises a series of stages by which batches of items on paper tape are matched with user profiles and successful matchings output on a line printer.

The first two of these programs are relatively short and straightforward enough not to merit further description therefore this appendix is mainly concerned with the dissemination program.

As mentioned above the disseminator is divided into a number of well-defined stages which are described separately. (In conjunction with this description the reader is referred to the flowchart in Fig. 11.)

Stage 1—Initialization

The program has been written to take advantage of the dynamic allocation facilities of the Egdon system. This stage begins by reading the following:

- (*a*) Number of items to be processed;
- (*b*) Number of profiles on master tape;
- (*c*) Size of major word glossary;
- (*d*) Number of journal titles on master tape.

Core storage is then allocated for the appropriate arrays. The user profiles and major word glossary are read from tape and the profiles transferred to the disc file. The input items are now read from paper tape into an array of data blocks (for layout of data block see Fig. 5). In the present system approximately fifty items per run occupying roughly 8 K of core, are disseminated to about one hundred users whose profiles occupy ~ 300–400 K of disc space. However since the amount of core used is easily controllable, if future loading increases then the input could easily be buffered and the disc used as backing store. The adaption of the remainder of the program to process a sequence of batches from the disc would be trivial.

Stage 2—Processing of Data Blocks

After the items have been read, sections (*i*) and (*v*) of the data blocks are complete. A character scan is made on the text and the authors and keywords of each item are extracted. The keywords are divided into major and minor words (after trivial words are discarded) by reference to the major word glossary.

Here relatively primitive techniques have been employed in the early version of the program and a considerable gain in speed would be expected from the use of more modern methods.

Stage 3—Matching Process

Each profile is read from the disc (where it is stored as a 300 word unit) and matched with successive data blocks (resident in core). The matching is made in three stages:

(*a*) Authors;
(*b*) Major keywords;
(*c*) Minor keywords (qualifying (*b*)).

In cases (*a*) and (*b*) plus (*c*), sections (*i*) and (*v*) of the matched data block are written to an output magnetic tape. Facilities have also been added to record partial matchings (i.e. (*b*) but not (*c*)) when both keywords and text are written to the output tape with an accompanying message.

Upon processing the last profile, the output tape is rewound and the final printing stage is entered. Here again this method of accumulating output on tape could easily be adapted to handle batched input (possibly by substituting disc for tape to allow sorting of blocks from different batches before printing).

Stage 4—Output of Results

Initially the master list of journal titles is read from magnetic tape overwriting the data blocks which are now redundant. Thus core usage is minimized and random access to journal titles, essential for efficient output, is simply achieved.

Now the output for each user is read from the output tape, combined with appropriate journal titles and printed in the format shown in Fig. 7.

All the printing routines have been written in Fortran, where the system of print formats is extremely flexible. Thus the presentation of output can easily be modified as new requirements demand.

ABSTRACT

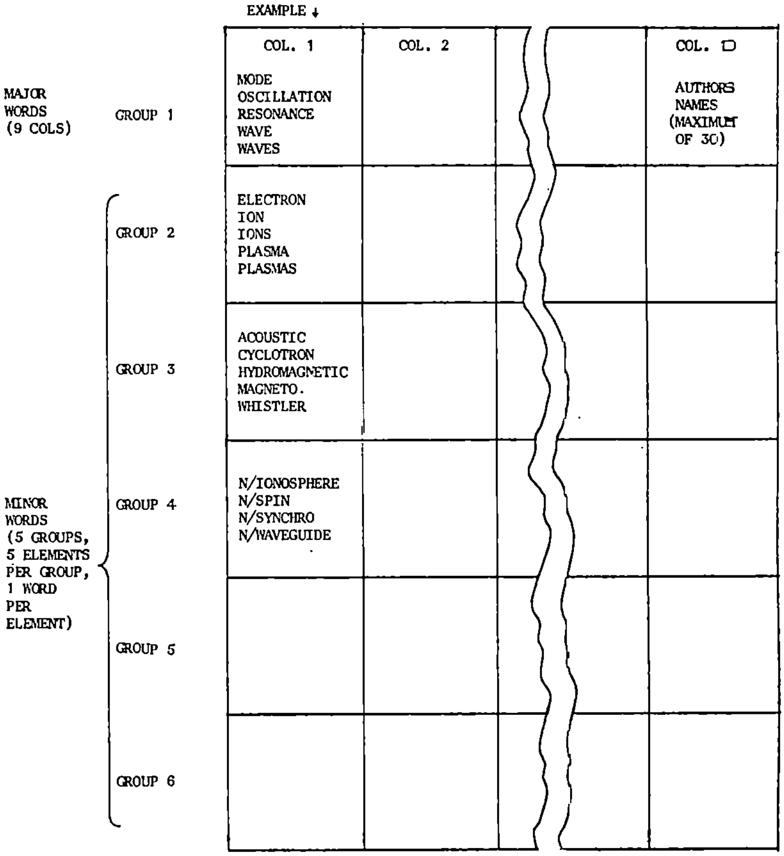
The paper describes a system which uses a KDF9 computer for producing an information bulletin and for disseminating information selectively to up to three hundred scientific and technical personnel in a research establishment operating in the field of plasma physics and controlled nuclear fusion.

The users' profiles are matched, in the computer, to the input of journal articles, reports, etc., on the basis of the language of the title only, i.e. no

descriptors are used in the input process (except very occasionally to clarify an ambiguous title). The input to the system is in the form of paper tape from a tape typewriter: output is by tape-typewriter for the information bulletin and line printer for the individual notifications.

A continuing check on the effectiveness of the system is maintained and some results relating to the first year of operation are given, together with a brief comparison of the cost of the computer system with that of the manual system previously employed.

The ultimate aim is to develop a system which will provide both a current awareness service and a retrospective retrieval service and in the latter case, one which can be used directly by individual scientists through an on-line network.



		EXAMPLE ↓ COL. 1	COL. 2		COL. D
MAJOR WORDS (9 COLS)	GROUP 1	MODE OSCILLATION RESONANCE WAVE WAVES			AUTHORS NAMES (MAXIMUM OF 30)
MINOR WORDS (5 GROUPS, 5 ELEMENTS PER GROUP, 1 WORD PER ELEMENT)	GROUP 2	ELECTRON ION IONS PLASMA PLASMAS			
	GROUP 3	ACOUSTIC CYCLOTRON HYDROMAGNETIC MAGNETO. WHISTLER			
	GROUP 4	N/IONOSPHERE N/SPIN N/SYNCHRO N/WAVEGUIDE			
	GROUP 5				
	GROUP 6				

Fig. 1 Layout of typical profile matrix
(Note that in this example Group 4 indicates a 'non-select' group)

EXAMPLE 1 Normal mode (1) subject interest – Light scattering by plasmas	EXAMPLE 2 Linked mode (3) subject interest – Design of superconducting coils	EXAMPLE 3 Selective mode (6) subject interest – Fast switches for high current gas discharge devices
Group 1 ELECTRON LASER LASERS LIGHT THOMSON	Group 1 CRYOGENIC KILOGAUSS Nb – Zr NIOBIUM – Zr SUPERCONDUCTOR	Group 1 4 IGNITRON 4 SPARK 4 SPARK GAP 4 SWITCHES 4 SWITCHGEAR
Group 2 PLASMA PLASMAS PROBE PROBING SCATTERING	Group 2 *CALCULATION *DESIGN *EVALUATION *PERFORMANCE *TYPES	Group 2 HIGH LARGE MULTI
	Group 3 COIL MAGNET MAGNETS MAGNETIC SOLENOID	Group 3 FAST RAPID
	Group 4 COILS	Group 4 AMPERE CURRENT
		Group 5 DISCHARGE GAS GASES PLASMA PLASMAS
		Group 6 APPARATUS DEVICE EXPERIMENT METHOD

Fig. 2 Examples of modes
(In example 3, n = 4 as shown by the numbers in Group 1)

113800
Journal of Vacuum Science and
Technology
→
113900
Kakuyugo-Kenkyu Nuclear Fusion
Research In Japanese
→
114000
Kosmicheskie Issledovaniya
In Russian
→
114100
Laboratory Equipment Digest
→
114150
Laser Newsletter
→
114200
Machine Design
→
114300
Machine Shop and Engineering
Manufacture
→
114400
Machinery
→
114500
Magnetic Materials Digest
→
114550
Magnitnaya Gidrodynamika
Magnetohydrodynamics In Russian
→
114600
Management Accounting
→
114620
Management Today
→
114700
Manager
→
114800
Marconi Instrumentation
→
114900
Mathematical Reviews
→
115000
Mathematics of Computation
→
115100
Miami University. Plasma Physics
Bulletin
→

Fig. 3 Journal coding

```
109805→55→6→June,1967→
    Frequency stabilization of gas lasers.
By G. Birnbaum.  p.1015.  X→

    Measurement of laser energy and power.
By G. Birnbaum and M. Birnbaum.  p.1026.  X→

019105→10→6→June,1967→
    Arc  measurement of high temperature  gas
transport properties.  By H.W. Emmons. p.1125.  B→

    Measurement of emission and absorption of
radiation by an argon plasma.   By D.L. Evans
and R.S. Tankin.  p.1137.   B→

118605→157→5→25 May,1967→
    Interaction of relativistic particles with
magnetic fields.   By O.P. Manley.  p.1232.  B→

123505→12→1→July,1967→
    Spectroscopic investigation of gas discharge
for argon ion optical lasers.   By V.F. Kitaeva,
Y.I. Osipov and N.N. Sobolev.  p.55.   B→

    The hydrodynamic equations in the theory
of superconductivity,    by A.V. Svidzinskii
and V.A. Slyisarev.  p.59.  X→

     Waves and noises in the positive column
plasma at low pressures.   By A.A. Zaitsev
and B.N. Shvilkin.  p.68.  B→

123506→11→12→June,1967→
    Quasilinear theory of a two-beam instability
( of a plasma ).   By A.V. Shutko.  p.1080.  B→

    Gas laser as a source of illumination.   By
I.V. Obreimov.  p.1086.  X→

105605→13→7→July,1967→
    Automatic plotting in the third generation.
By D. Talley.  p.22.  B→

    Terminal networks for time sharing.    By
T.C. O'Sullivan.  p.34.  B→

103505→14→1→28  May,1967→
    Electron  impact ionization cross sections
and ionization rate coefficients for atoms and
ions.   By W. Lotz.  31p.  B→

109905→4→7→July,1967→
    Commercial satellite communications experience.
By E.J. Martin and W.S. McKee.  p.63.  X→
```

Fig. 4 Input to computer (journal articles)

150000→00→00→7 August,1967→

Solar photosphere temperature profiles

AFCRL 67-0259
Lowell Technological Institute
Research Foundation
Solar corona study: Final report for 1 February 1964 - 31 October 1966.
By K.S. Kim. January,1967. 18p. B→

High power giant pulse lasers gas breakdown

CTO 392
United Kingdom Atomic Energy Authority
Research Group Culham Laboratory
Translations Office
Evaporation of matter by laser radiation.
By Y.V. Afanasiev and O.N. Krokhin. May,1967. 13p. Translation of Zhurnal Experimentalnoi i Teoreticheskoi Fiziki, vol.52, no.4, 1967, pp.966-975. B→

Up-to-date reading list

Culham Laboratory Library
Reading List No 1 (Rev)
United Kingdom Atomic Energy Authority
Research Group Culham Laboratory Library
Plasma physics and nuclear fusion research: A selected list for the general reader.
May, 1967. 2p. B→

Attitude control unit

ESRO SM-67
European Space Research Organisation
Solar XUV observations from stabilised Skylark rockets.
By R. Wilson. April,1966. 16p. C→

Solar coordinates space vehicles stabilization

ESRO SN-10
European Space Research Organisation
Determination of the position of the sun on the basis of the mean solar elements.
By H.G. Walter and M.K. Schafer. November, 1966. 7p. B→

Results of survey need for standard program

NEL Rep 291
National Engineering Laboratory
A survey on part programming for point-to-point numerically controlled machine tools.
May,1967. 22p. B→

Fig. 5 Input to computer (reports)

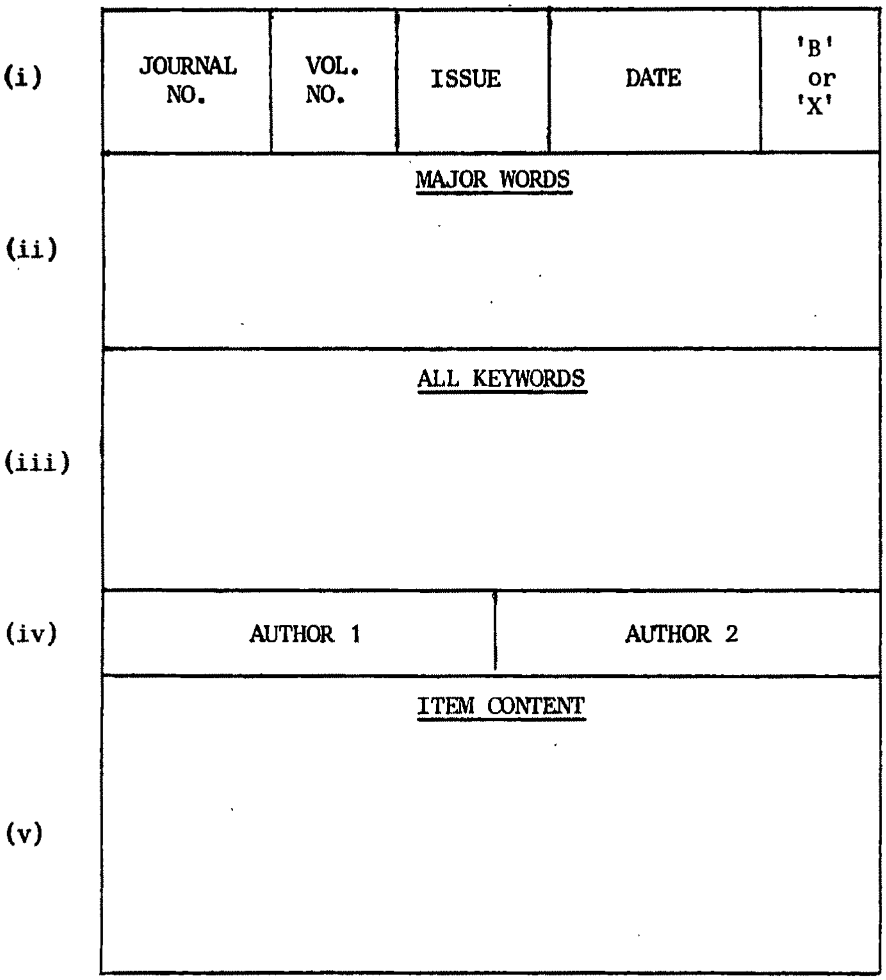


Fig. 6 Structure of data block

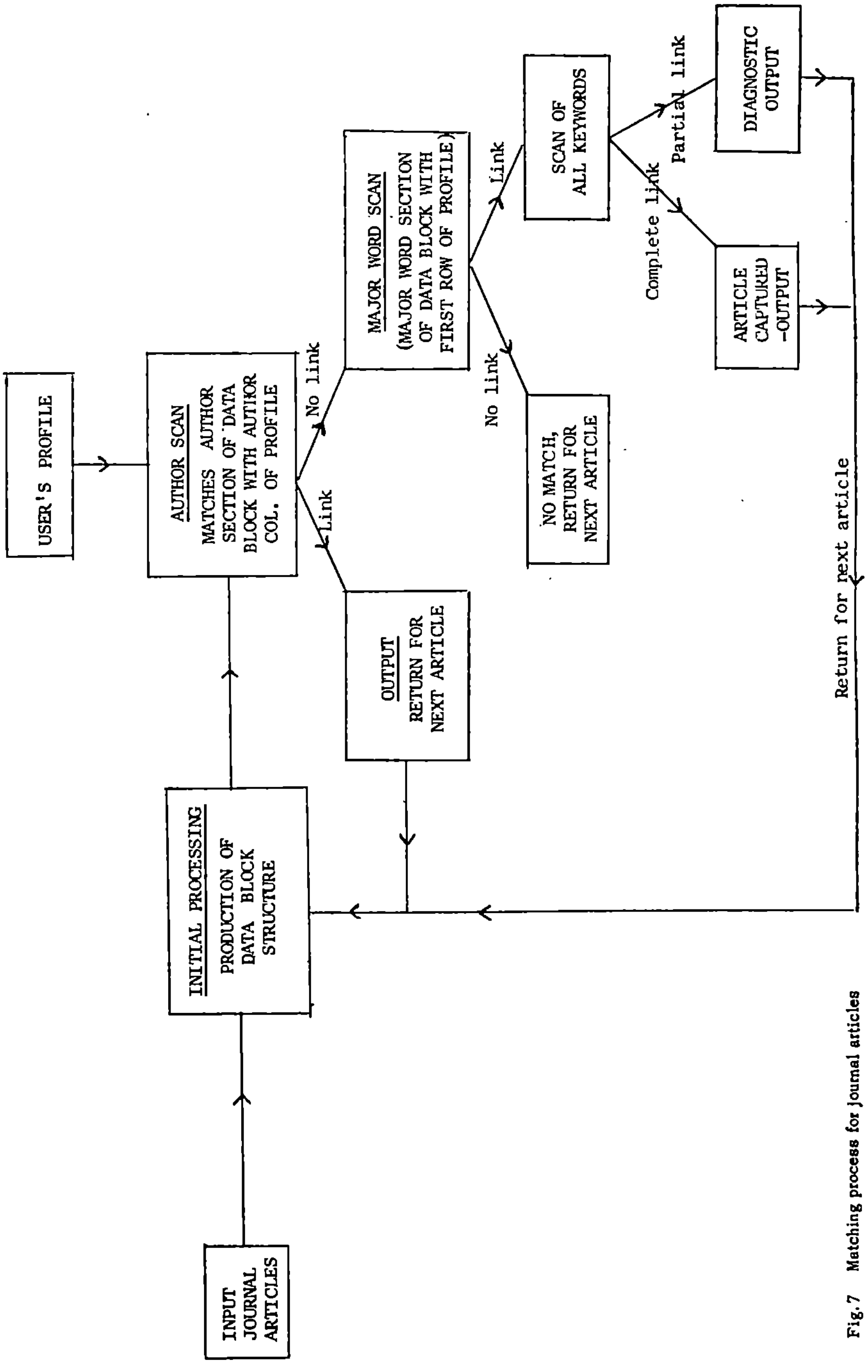
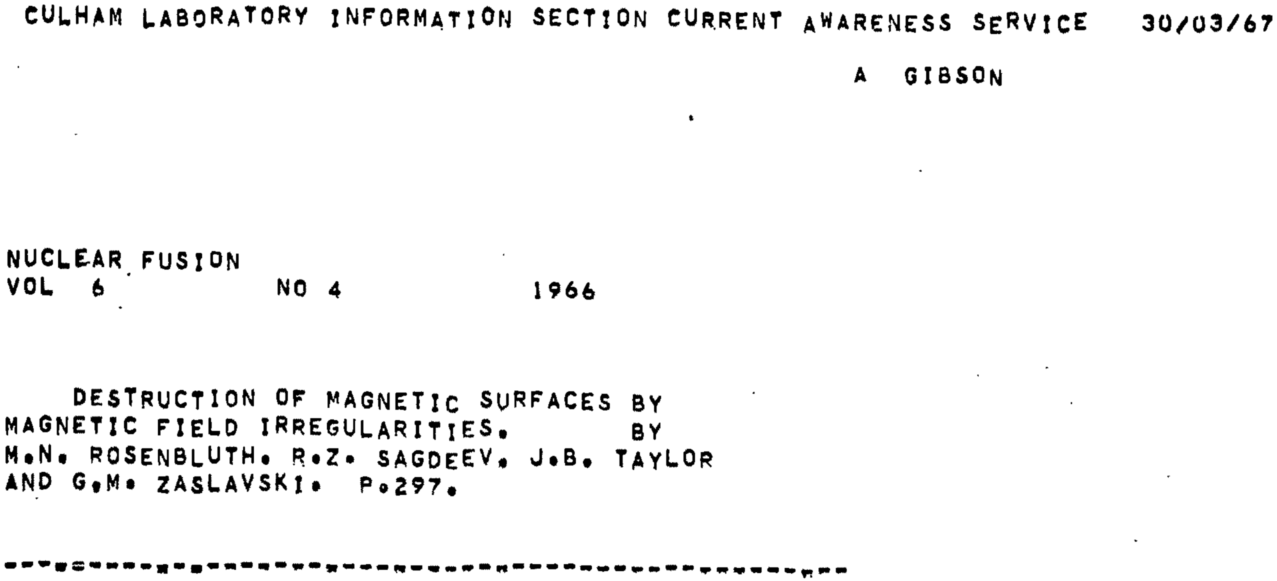


Fig.7 Matching process for journal articles



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CULHAM LABORATORY INFORMATION SECTION CURRENT AWARENESS SERVICE   30/03/67
                                                          A  GIBSON



NUCLEAR FUSION
VOL  6          NO 4             1966


   DESTRUCTION OF MAGNETIC SURFACES BY
MAGNETIC FIELD IRREGULARITIES.       BY
M.N. ROSENBLUTH. R.Z. SAGDEEV. J.B. TAYLOR
AND G.M. ZASLAVSKI.  P.297.


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Fig. 8 Line printer output

American Institute of Aeronautics
and Astronautics. AIAA Journal
vol. 5, no. 7, July, 1967

266/12
Measurements of viscosity and thermal conductivity of partially ionized argon plasmas. By A. Kanzawa and I. Kimura. p.1315.

266/13
Nonsteady coaxial arcs in fully developed plasma flow. By D.A. Prelewicz and D.M. Benenson. p.1320.

Electrotechnology
vol. 79, no. 6. June, 1967

266/14
Real time electro optical information processors. By S. Herman. p.52.

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Principles of dielectric engineering. By A. Blanck. p.73.

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266/17
New figure of merit for ceramic permanent magnets. By J.R. Ireland. p.100.

Journal of Applied Physics
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266/22
Two stream instability in semiconductor plasmas. By B.B. Robinson and G.A. Swartz. p.2461.

266/23
Wing slope techniques for the analysis of Langmuir probe characteristics in a low density plasma. By R.T. Bettinger. p.2523.

266/24
Radiation from current sources in an isotropic plasma. By D.J. Connolly and B.S. Tanenbaum. p.2557.

266/25
Thick cylindrical coil systems for strong magnetic fields with field or gradient homogeneities of the 6th and 20th order. By M.W. Garrett. p.2563.

266/26
Thermal emission microscope studies of cesium surface ionization on porous refractory metals. By D.M. Jamba and O.K. Husmann. p.2630.

266/27
Control of ion acoustic wave instabilities in a gaseous discharge. By J.T. Coleman. p.2655.

INPUT				MATCHING			SELECTIVE DISSEMINATION											USERS		BULLETIN	
Bulletin Number and Date	Running Number	No. of Articles Fed In	Running Total	No. of Different Articles Selected for SDI	Running Number	Per Cent of Input	No. of Notifications sent	Running Total	(a) Relevant Items	Per Cent	(b) Partly Relevant Items	Per Cent	(a) and (b)	Per Cent	Running Total (a) and (b)	Non-relevant Items	Per Cent	No. of Users in System	No. of Users Receiving Notifications	No. of Items for Bulletin	Running Total
233	1	54	1918	32	1114	59%	90	2374	85	94%	3	3%	88	97%	1520	2	3%	70	36	51	1291
19/11/66	2	14	1932	13	1127	92%	40	2414	39	97%	1	3%	40	100%	1560	–	–	70	22		
234	1	25	1957	21	1148	84%	75	2489	61	81%	8	10%	69	91%	1629	6	8%	70	30	66	1357
26/11/66	2	61	2018	42	1190	68%	148	2637	140	95%	5	3%	145	98%	1774	3	2%	70	40		
235	1	43	2061	35	1225	81%	113	2750	106	94%	4	4%	110	98%	1884	3	2%	70	35	53	1410
3/12/66	2	19	2080	13	1238	68%	41	2791	41	100%	–	–	41	100%	1925	–	–	70	26		
236	1	33	2113	23	1261	70%	61	2852	56	92%	4	7%	60	99%	1985	1	1%	70	26	48	1458
10/12/66	2	23	2136	13	1274	57%	32	2884	29	91%	1	3%	30	94%	2015	2	6%	70	13		
237	1	33	2169	21	1295	63%	71	2955	70	98%	1	2%	71	100%	2086	–	–	70	27	45	1503
17/12/66	2	35	2204	26	1321	74%	66	3021	59	89%	3	5%	62	94%	2148	4	6%	70	27		

Fig.10 Extract from statistics relating to journal articles

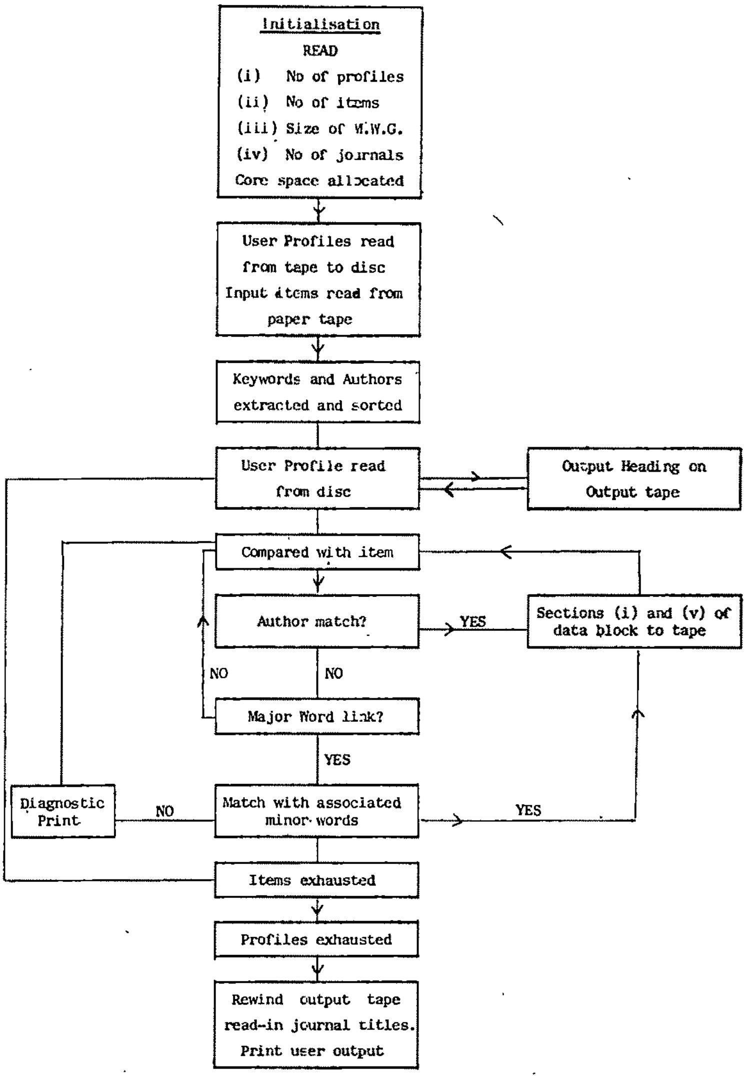
Initialisation
READ
(i) No of profiles
(ii) No of items
(iii) Size of M.W.G.
(iv) No of journals
Core space allocated
User Profiles read from tape to disc
Input items read from paper tape
Keywords and Authors extracted and sorted
User Profile read from disc
Output Heading on Output tape
Compared with item
Author match?
YES
Sections (i) and (v) of data block to tape
NO
NO
Major Word link?
YES
Diagnostic Print
NO
Match with associated minor words
YES
Items exhausted
Profiles exhausted
Rewind output tape read-in journal titles. Print user output

Fig. 11 Flowchart of Dissemination Program

SEARCH STRATEGY EVALUATION IN MANUAL AND AUTOMATED SYSTEMS

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Paper presented at the 41st Aslib Annual Conference, Harrogate, 9th–12th October 1967

1 Introduction

Document retrival systems are designed and implemented for the purpose of satisfying the information needs of a group of users, and the final stage of the technical processes required is the search of the stored file of documents or document surrogates. Studies of many aspects of retrieval systems have been made, but work has concentrated on the indexing or input stage, and little attention has been paid to the search or output stage.

The search stage is that part of the operation of a system that is carried out after a document store has been set up together with the necessary physical and semantic rules of access to it, and includes all actions taken from the receipt of a search request to the point where the search for, and examination of, documents is terminated. The search strategy itself is the intellectual part of this process, and requires a series of decisions concerning request and system terminology, decisions that normally vary from request to request and that are subjective in nature, depending for success on the skill of the searcher and effectiveness of the system. An evaluation of the decisions made in searching a particular set of search requests in a given system may, if the evaluation test is designed with care, be used to advance knowledge about searching generally if the test is of an experimental nature, or, if the test is of an operating system, its performance may be capable of improvement. Criteria for evaluation and some new user oriented techniques of performance measurement are discussed in section 2.

The introduction of mechanized methods for document storage and retrieval has not so far radically affected the intellectual aspects of searching. The promise of automation to come should encourage an examination and evaluation in detail of search strategies used in manual systems, and in section 4 a preliminary and brief treatment is given. Automation is discussed and defined in section 3, and, using the experience being gained from one experimental system which is investigating the design of automatic systems, some ideas on the way in which automatic systems will be searched are given in section 5.

2 Evaluation

The evaluation of the search stage may be carried out from the viewpoints of both users and system managers, and several criteria have been suggested.[1] A satisfactory retrieval performance seems to be of paramount importance, since a user whose need is not met by the search is unlikely to be impressed by a short response time or the ease of physically consulting an index. User criteria such as time and effort, and also the management criterion of cost are inseperably linked to particular systems in particular environments, but aspects of systems that involve retrieval performance may more easily be made the subject of evaluation tests, and results taken mainly from experimental simulation tests are presented in this paper.

Since evaluation tests of this type require, in relation to the search requests, a set of relevance decisions, results presented are from tests which use quite small document collections but have exhaustive relevance decisions: that is, every document in the collections used has been examined for relevance to every search request. Details of the different possible techniques for making relevance decisions are not given here, since descriptions of methods used in the three sources involved appear elsewhere.[1, 2, 3]

Retrieval performance effectiveness from a user viewpoint is best reflected by the twin measures of recall (amount of relevant material examined) and precision (amount of examined material relevant), and results of searches may be presented as a graph as seen in Figure 1. A curve, rather than a single point is obtained in these examples by successively searching on up to five search terms in the index, and calculating the recall and precision ratios that are obtained after each term has been searched, to give the five symbols on each curve on the graph. The curves presented are all based on thirty-five search requests, with the recall and precision ratios achieved by each request combined to give an average consisting of the arithmetic mean of the performance ratios of each request.

Several evaluation tests have purported to use what has become the accepted precision ratio,[4, 5] but on examination it is seen that although the searchers examined all documents posted under the search terms used, they then made a selection of the documents they considered probably relevant to the request and based the calculation of precision (and presumably recall) on this selection only. Although this searching technique is clearly an accepted and valuable one the result is highly dependent on the searcher's ability to recognize what is relevant, and introduces a variable that is unwanted for most aspects of an evaluation test. Precision measured this way will be considerably different from the system precision normally calculated, and it is suggested that it be referred to as a 'Selected Precision Ratio'. The system recall and precision results given in Figure 1 have also been searched this way by a searcher presented only with a written statement of the requests but using the same search terms as were used for the system performance results, and the high selected precision results giving ratios above 90 per cent can also be seen in Figure 1, together with a drop in recall.

Another type of precision ratio of lesser importance, but which may be useful for comparing certain types of indexes is an 'Index Entry Precision Ratio'. For this the total number of documents examined (the denominator of precision) is replaced by the total number of distinct index entries examined, so that in indexes where entries for a given document are made in more than one place these may be accounted for, since it has been the practice in calculating system precision never to count the same document more than once. Search results of this type are again presented in Figure 1 since it is a KWIC index that is being searched, and the necessarily unchanged recall but lower index entry precision may be seen.

A final matter concerns recall, which in experimental tests conducted so far has been calculated on the basis of the total number of relevant documents in the file. However, for users requiring high precision and only say two or three relevant documents, satisfaction is reached before 100 per cent recall is reached if there are many relevant items in the file. Recall can therefore be calculated relative to the user's needs based on the number of relevant documents the user would like to see, to be described as 'Relative Recall'. Assuming that all thirty-five requesters had a high precision need, the position of the relative recall and either system precision or selected precision curves may be seen in Figure 1.

Results presented in this paper use the system recall and precision measures, since data for the use of relative recall is not available. A ratio known as the fallout ratio (amount of non-relevant examined in relation to total non-relevant in file) has certain advantages over precision for experimental work, but its use would not significantly alter the comparisons made here, and precision is a superior measure from the vital user oriented viewpoint. A post-search analysis of individual search results is a necessary part of evaluation work, and a variation of methods in use is described as a 'Hindsight' performance result. This is an extension to a failure analysis in which errors or poor decisions are replaced by the optimum possible decisions, in order to calculate the performance that would be possible if one part of the system were perfect.

3 Manual, Mechanized and Automated Systems

In the context of the search stage, manual systems are those in which intellectual decisions relating to all aspects of a search have to be made at the time of search of a request, and the examination of the index entries is also done by hand. Some systems employ mechanized means to construct the physical index and add new documents (KWIC indexes and some post-co-ordinate indexes, for example), but these are still manually searched. Introduction of mechanization to searching is almost entirely restricted to the physical scanning of the index, so that complex search formulations requiring considerable skill are needed, and the lack of provision for altering the search strategy during the physical search that is commonly experienced with computers makes successful searches difficult to achieve. Promises of future automation are frequently made in vague terms, and the place for, and extent of, human intellect and skill that will still be required is rarely considered.

To automate is more than to mechanize. The concept of automation in engineering adds to the brute force of mechanization the sensitive treatment of control devices, which use sensing and measuring instruments to permit changes to be made during a mechanized operation so that the result may be optimized to meet the circumstances. Feedback may either be applied by the system itself, based on intellectual decisions about foreseen events that have been programmed into the system, or, when abnormal situations occur, the attention of a human operator may be invoked to make the necessary decisions and changes.

In documentation, mechanization is rightly being used in some circumstances to carry out clerical tasks of a repetitive nature, and application to the drudgery of searching pre-formulated requests in a large system such as Medlars is a good example. But any claim to automation requires more than this, and only when the following three elements are met is automation being achieved:

1 Some intellectual tasks are avoided altogether.
2 Some intellectual tasks that are in manual systems performed many times are performed once only and applied by the system as needed.
3 The intellectual tasks that are indispensable are directly provided for by the use of systems that allow direct user-system communication, give a rapid response time, and permit sophisticated user feedback.

An example of the first element would be the replacement of the human indexing task by some form of automatic indexing, which at its simplest uses the natural language of the documents (or document abstracts) as input to the system. Although automatic indexing as a process is devoid of intellect, except for the rules that are programmed into the system, it is not correct to regard the result as containing no intellect at all since it is really the intellect used by the authors who wrote the documents that is being used as a substitute for indexing effort. A second example would be the use of statistical association techniques to reveal relations between words, to be used in place of hand-made classifications and thesauri, but present techniques nearly always give inferior results to the hand-made versions.

The second and third elements suggested as essential to automation are particularly applicable to search strategies, so a list is given of six types of decision which are required in manual search strategies:

1 Translation of user's request into terminology of system.
2 Choice of related vocabulary terms by which to extend the search to cover all possibly useful topics.
3 Statement of all search terms in their required logical combinations, necessary only for post-co-ordinate systems.
4 Choice of an order in which the search terms or search statements will be tried.
5 Decision as to point at which search is terminated.
6 Use of feedback to make adjustments to some of the preceding decisions as a result of examining some documents.

Decisions of types 1, 2 and 3 are very critical in mechanized search systems because the entire search formulation must usually be made in advance of the search, and the formulation made directly determines decision 5, usually called the cut-off point. If too few or too many documents are retrieved user satisfaction will suffer, because time and cost often preclude re-searching a request in a large file. Topic 6 is important because the person-to-person interaction between requester and searcher possible in many manual systems permits quite sophisticated feedback during the search and contributes to success. Some requesters prefer not to delegate searching to system operators at all, and wish to browse or examine a few items in order to formulate their need more clearly; and even when information centres serve remotely located users the human searcher is an important intermediary. If these are the topics that are candidates for automation then no known operating system is yet fully automated, but sufficient knowledge is being gained by experimental work to give some results and discussion in section 5.

4 An Analysis of Strategies for Manual Systems

The analysis is based on the six types of decision listed in the preceding section, and after a description of the matters involved in each decision some comments on evaluation with examples are given.

Request translation is the task of taking the search request and representing it by the terms in the vocabulary of the system. If an adequate lead-in vocabulary is provided this can be a clerical task, except that several important decisions may be made at this point. For example, it may be decided that some parts of a search request need never be incorporated in the actual search, or that some notion in the request may always be searched more generically than the requester's statement. These are best described as decisions about the 'exhaustivity' and 'specificity' of the complete search, as defined in reference 3. Also, it may be decided that one of the request notions is quite vital to the whole request, so that this important notion should be included in every individual programme of the complete search formulation, even when extensions to related notions are made, and individual programmes reduce exhaustivity and specificity.

Quality of request translation may be evaluated by post-search analysis, and in one particular test cases of undesirable reduction in exhaustivity and specificity of the complete search were the cause of 65 per cent of the failures due to searching.[3] Such failures limit the precision ratio that can be achieved, and also affect recall to a lesser extent.

Choice of search terms is rarely confined to those suggested by the request words directly translated, and other related vocabulary terms are often included in the search. The decisions as to which related ideas to follow up is determined by the requester's requirements, since a high recall need may require the use of many related terms, but a high precision need is served by use of only those terms which are most closely related, such as real synonyms. Formal provision of useful relations between vocabulary terms is frequently provided by means of classification schemes or thesauri. Such formal aids may be less necessary than is realised when experienced searchers are used, as one result shows.[6, page 91]

Evaluation of the choice of terms in search programmes is often the subject of a post-search analysis.[3, 6] It is also possible to calculate 'hindsight' performance results to show exactly how much loss in performance is caused by a less than optimum choice of search terms, and an example of this is given in Table I. The manual KWIC index searches previously used in Figure 1 are made on a collection in the subject of documentation, and the KWIC index is made from the full document abstracts rather than just titles, so the data in Table I show how both better recall and precision are attainable in theory.

Pre-co-ordinate systems require only search term choice and order decisions, but for post-co-ordinate systems there is the additional need to formulate the logical relations in which the individual terms are to be searched, using such relations as AND, OR and NOT. Reduction in exhaustivity and specificity may easily be accomplished by demanding fewer of the search terms in logical product co-ordination, and the question arises as to whether this method of extending the search (to improve recall) gives better performance results than the addition of more related terms. In the context of the aerodynamics collection and the experimental procedures used in the second Cranfield Project, the conclusion is that reduction in search term co-ordination gives superior results to the addition of related terms from the synonym list.[8] Figure 2 shows that, on average, a search demanding three terms in co-ordination achives 25 per cent recall, so that if the recall is too low either the addition of related synonyms or the reduction in co-ordination to two terms increases recall to around 50 per cent, but the latter method achieves a better precision ratio.

The search term order decision relates to the order in which the choices of search terms and combinations of search logic will be tried, and naturally the principle used is the order of expected decreasing relevance. The matter of order does not arise in mechanized search systems, where the whole search formulation is usually processed at one time, but in manual systems a good choice of order will result in a quicker and more acceptable search result at higher precision. For example, the manual search of the KWIC index has been analysed for search term order, and Figure 3 gives two additional curves that represent the best and worst possible orders, together with the curve for the actual result.

The search cut-off is the point at which a search is terminated, and in manual systems this may be done as soon as the requester is satisfied with recall, or may be delayed either until the requester is unwilling to examine more documents or until no suitable further choice of search terms can be made. In a non-interactive mechanized search system it is usual to spend a lot of effort on search term choice and logic in an effort to make a correct cut-off, and supplementary information such as term posting frequencies is often used in an attempt to estimate the number of documents that will be retrieved using a given search formulation. Post-search evaluation of cut-offs may be done as illustrated in Table II. Results from reference 3 are analyzed in terms of the total numbers of documents retrieved, assuming for the sake of this example that where the cut-off equalled the total number of relevant documents in the file ('Timely' Cut-off) this is the perfect result, although the system does not necessarily give 100 per cent recall and precision in such cases. 'Too Late' cut-offs, where more documents are retrieved than there are relevant, can never give perfect precision, and 'Too Early' cut-offs, where fewer documents are retrieved than there are relevant, can never give perfect recall, so the actual results of the 114 requests in a test of two systems are given in Table II.

Feedback in manual systems has undisputed value, but a test in which feedback is monitored for evaluation purposes is not known to have been made.

5 Towards Search Strategies for Automated Systems

The experimental automatic system used to illustrate this section is known as the SMART system, described in.[9, 10, 11] Documents are stored in the system initially in natural language, and a variety of word dictionaries are provided, some manually and some automatically constructed, with other optional types of weighting scheme and search matching functions. Present work is centred on tests that simulate the user-system interaction that will be possible when remote consoles and time sharing computer equipment become available to permit full scale operational testing.[12, 13] No single mode of interaction can yet be advocated, since the ideal amount of human control for automated systems is not yet fully known, and provision of different levels of 'strong' and 'weak' user-system interaction would permit requesters to decide for themselves. Some of the possible search strategies, choices and decisions involved are described, using the six manual steps as a framework.

No human request translation is necessary in SMART since search requests are put to the system in natural language as received. A growing operational system would require any new words encountered to be added to the stored vocabulary dictionaries but no special hand processing of request notions is essential. However, it has been found that long request statements give a better performance than short ones,[7] so that for users willing to interact strongly a few simple rules would improve performance. Even if requesters simply marked the important words in their request the system could automatically assign higher weight to these words, and would give performance improvements such as that seen in Figure 4, where modified requests are seen to perform better than requests searched without identification of the important words. With an automatic system there is no possibility of being less exhaustive or specific than the request statement in some part of the search, so that failures of the type noted earlier are avoided. Relevant to many of the search steps being discussed is the use by SMART of weighting schemes, based mainly on word frequency, which are found to improve retrieval performance compared to nearly all cases where no weighting is used. High frequency words which are of no value for retrieval purposes such as articles and prepositions are removed automatically by means of a deletion list.

Search term choice is achieved in SMART by means of several pre-constructed and computer stored vocabulary dictionaries. These dictionaries each provide groupings of natural language words on the basis of some well known principle, such as suffix removal to reduce to stems, synonym and near synonym recognition by either a manually constructed thesaurus or a machine computed list of statistical associations based on frequency counts, use of phrases rather than single words, use of hierarchical relations and the use of syntactical rules. Search formulation is therefore not carried out manually at the time of search at all, since all that is required is the choice of one or more of the dictionaries to use. This choice may be determined by use of only those dictionaries that are proved to be the best on average in tests, and Figure 5 shows that in a documentation collection the full synonym dictionary (thesaurus) performs better than those which use types of suffix removal only. This result conflicts with the aerodynamics result in Figure 2 for reasons that are partially known. Another possible strategy would be to provide several dictionaries so that a user dissatisfied with the result on one could try the others, perhaps also using a technique that combines the search results from several dictionaries into one output list. A further possible strategy would be to devise some means of automatically making a pre-search dictionary choice if it was found, for example, that long requests work better with a dictionary based on word stems, and short requests require a thesaurus. Although some correlations of this kind have been discovered,[7] they are not sufficient to make an accurate enough dictionary choice, but if some method were developed using some factors not so far considered then Figure 6 shows that correct advance choices of the word stem and thesaurus dictionaries would give a better result than either of the dictionaries used exclusively. This is because in this case ten of the requests work better with the word stem dictionary, and twenty-five are better with the thesaurus.

It is not claimed that the use of pre-constructed dictionary groupings gives as good a result as can be achieved by search term choices made at the time of search for an individual request, but evidence is growing to show that procedures used may well give a performance that is satisfactory for many users with resulting advantages in search time, cost and effort. However, any users willing to interact strongly with the system should still be able to use displays of relevant dictionary categories and be able to make individual choices of search terms with as much freedom as is enjoyed in manual systems.

No series of logical statements of search terms have to be manually formulated in SMART. A quite new approach is used that automatically allows progressive relaxation of the logic to an apparently ridiculously low level. Even documents containing any one of the search terms are matched with the request by the system, even though this means that often 30 per cent to 50 per cent of the documents in the collection are so matched. But all matched documents are not necessarily retrieved because they are all arranged in an order of decreasing match, so that the searcher may examine only the highly matched documents at the top of the list, or he is free without further searching to look at more documents further down the ranked list. The matching algorithms that achieve this ranking employ factors in addition to simply the number of search terms that match in a document, and factors such as the length of the document and the values assigned to each term by the weighting scheme are used. Some loss in precision performance probably occurs because not all the spurious matches (i.e. noise) are successfully relegated to low rank positions on the output list, but the inclusion of the special factors mentioned makes up, in part, for this deficiency, and the avoidance of manually formulated logic is a gain.

Any decisions of the order in which the terms are to be searched is not required, since in common with mechanized systems the complete search is carried out in one operation. The decisions relating to order of use of optional dictionaries have been considered.

The provision of a ranked search output list permits the cut-off decision to be quite independent of search term choice or logic, and allows the searcher to examine as few or as many documents as he chooses. Thus any searches in the manual or mechanized system that exhibited cases of 'early' or 'late' cut-off in Table II could be avoided in a ranking system if the searcher was able to recognise the need to look at a greater or smaller number of documents.

User controlled search strategies for automated systems will probably include a technique of great promise developed for SMART known as 'relevance feedback'. This is achieved by first making an initial search of the request in which the searcher examines just a few of the top ranked documents only, and then makes speedy relevance judgements by indicating which documents probably are, and which probably are not, relevant to his need. This relevance information is then returned to the system so that the original search request may be automatically modified to make it more similar to the documents judged useful, and less similar to documents judged valueless. The modified request is then searched, and this procedure may be iterated many times. Figure 7 uses some of the very first results of this, and it can be seen that this procedure steadily improves performance since an 8 per cent higher precision is gained in two iterations for users who want 70 per cent recall, compared with the use of a full search without feedback.

A conceptual flowchart of user-system interaction possibilities is given in Figure 8. Users can have the option of aiding terminology choice actively or using stored dictionaries. They should enter the approximate number of relevant desired and indicate the number of non-relevant they will tolerate so that the system can choose the best matching algorithm and weighting scheme; then, on examination of some output users can re-cycle the process by supplying relevance feedback information or making search terminology changes; and certain simple additional parameters will allow a simultaneous bibliographic search, so that using the documents that the user has said are relevant, the system will also search for other documents by the same authors, and documents having strong citation similarity. Experiments with SMART are continuing to simulate all the separate parts of such a system, and future work will move towards a combined system of this type in an operational environment.

ABSTRACT

Examination of the intellectual aspects of searching document retrieval systems identifies the different types of decision required, and a contrast is made between manual and mechanized systems currently in use and the SMART experimental automatic system. Evaluation measures are discussed and some test results presented.

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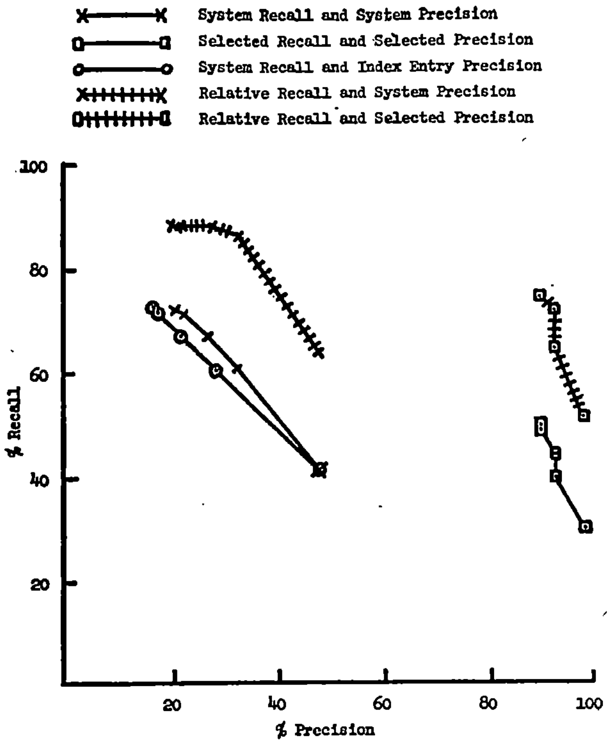
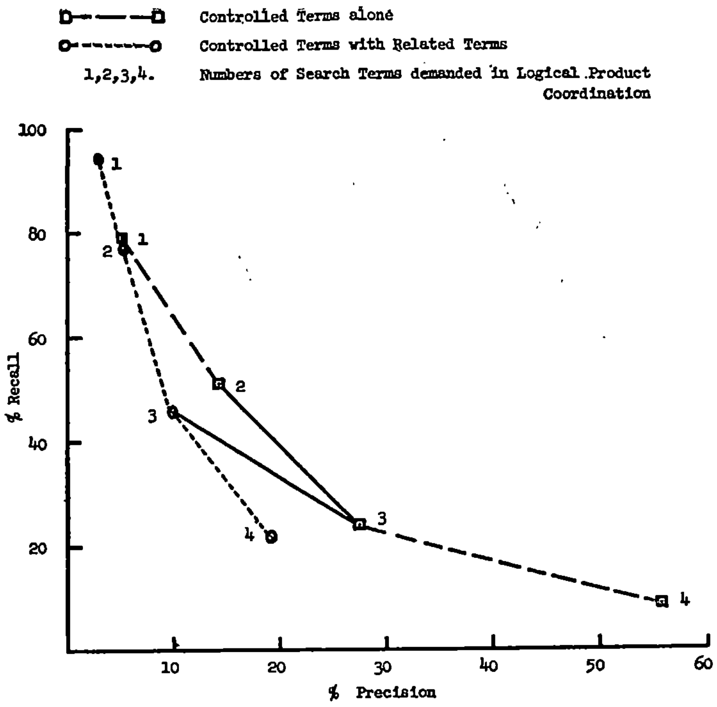


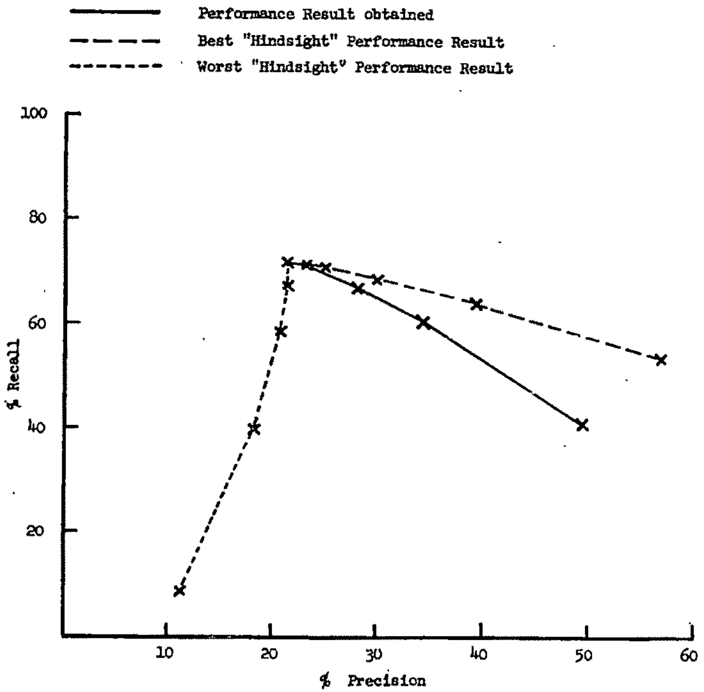
Graph of various kinds of recall and precision ratios from searches in a KWIC index to the full abstracts of a collection in documentation (used by SMART), based on averages over 35 requests.

Figure 1



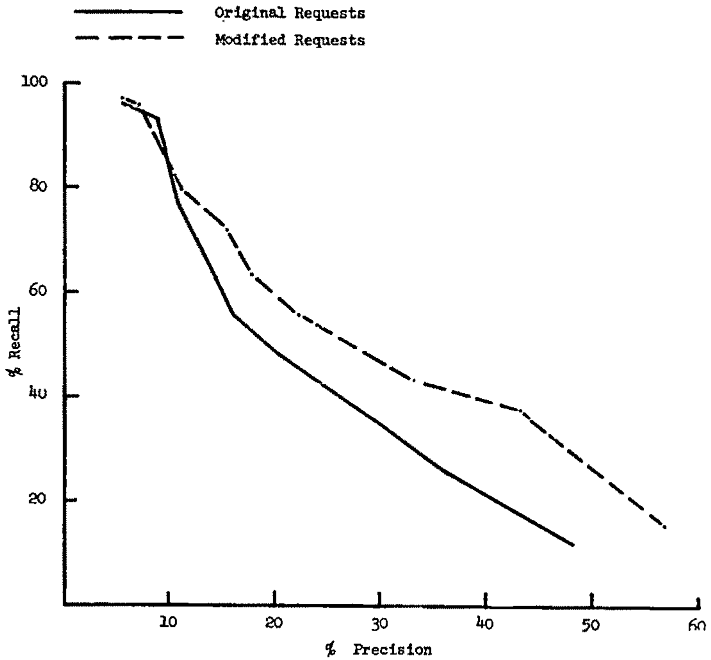
Data from Second Cranfield Project showing effect of changes in search term coordination and use of related terms, from Figures 4.820T and 4.824T[8], using an aerodynamics collection of 350 documents and averages over 77 requests.

Figure 2



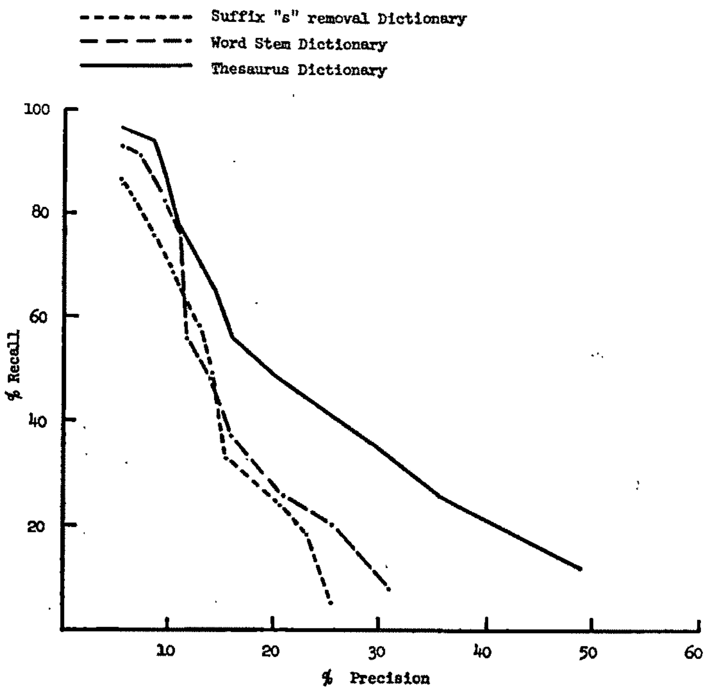
Evaluation of search term order decisions made in the KWIC index searches.

Figure 3



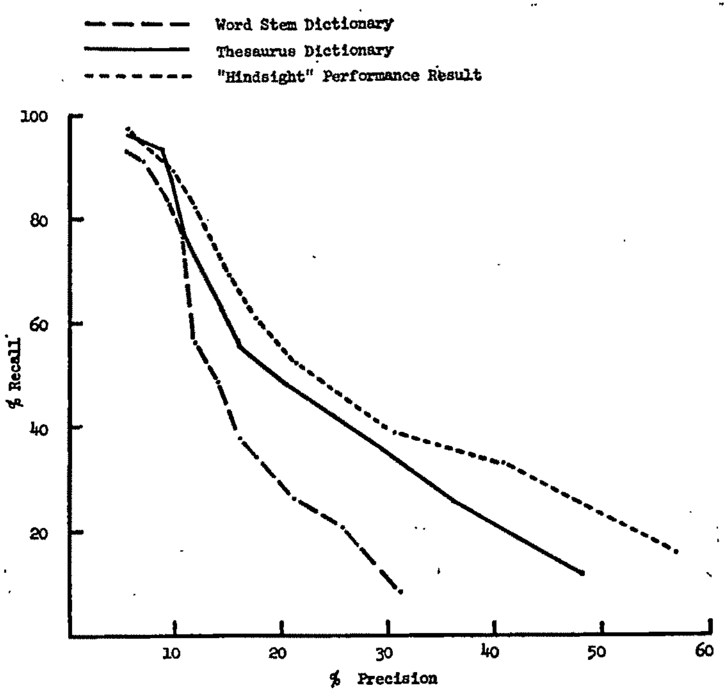
Comparison of original requests searched as received with modified requests having important words tripled in weight, using the SMART automatic system, the collection of abstracts in documentation, a thesaurus dictionary and based on averages over 35 requests.

Figure 4



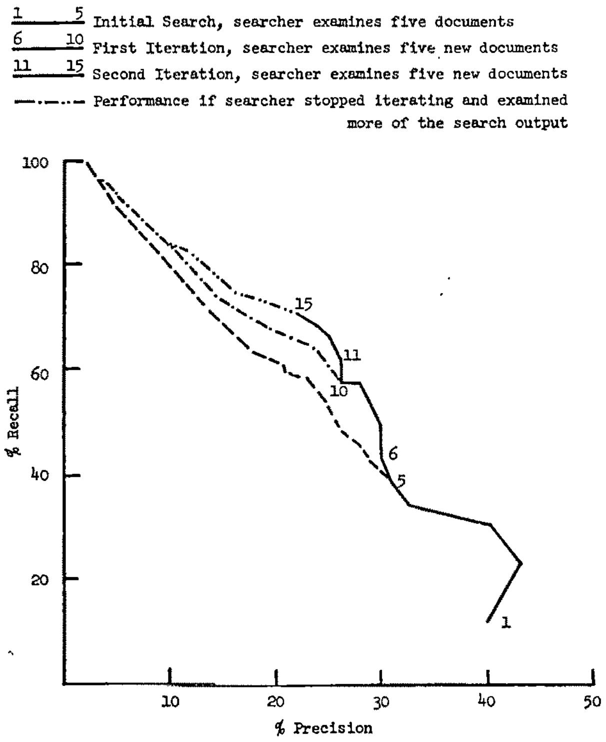
Comparison of merit of three different dictionaries on SMART, using the the collection of abstracts on documentation, and based on averages over 35 requests.

Figure 5



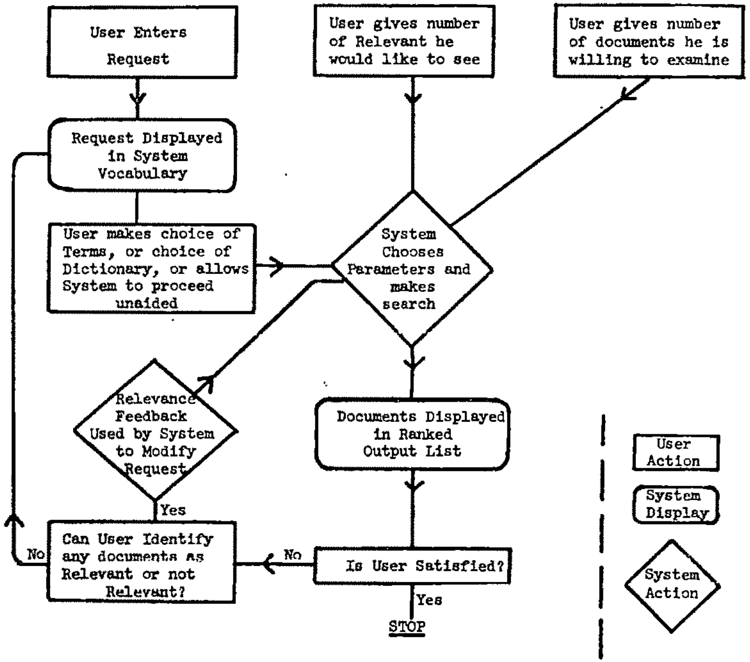
Comparison of two dictionaries with the performance of correct (by hindsight) dictionary choices for the individual requests, using SMART collection of abstracts in documentation, based on averages over 35 requests.

Figure 6



Results of searches using relevance feedback on SMART from[13], using the collection of abstracts in aerodynamics, based on averages over 42 requests.

Figure 7


User Enters Request
User gives number of Relevant he would like to see
User gives number of documents he is willing to examine
Request Displayed in System Vocabulary
User makes choice of Terms, or choice of Dictionary, or allows System to proceed unaided
System Chooses Parameters and makes search
Relevance Feedback Used by System to Modify Request
Documents Displayed in Ranked Output List
Yes
No
Can User Identify any documents as Relevant or not Relevant?
No
Is User Satisfied?
Yes
STOP
User Action
System Display
System Action

Flowchart of User-system interaction in an automated system

Figure 8

	Number of Search Terms	Documents Retrieved	Relevant Documents Retrieved	Recall	Precision
1 Terms selected in search	3.3	20.7	3.1	71.8%	22.3%
2 Terms Matching only with non relevant deleted from 1	2.2	15.7	3.1	71.8%	30.1%
3 Terms matching relevant not retrieved added to 1	4.2	22.1	4.1	89.5%	26.1%
4 Terms in 2 deleted and in 3 added to 1	3.1	17.2	4.1	89.5%	39.1%

Evaluation of search term choices made in the KWIC index searches, giving "hindsight" performance results averaged over 35 requests.

Table I

Performance Achieved	Cut-off Type			Totals
	Too Early	Timely	Too Late	
100% Recall and 100% Precision		7 (23)		7 (23)
100% Recall and <100% Precision			57 (39)	57 (39)
<100% Recall and 100% Precision	8 (17)			8 (17)
<100% Recall and <100% Precision	10 (9)	2 (6)	30 (20)	42 (35)
Totals	18 (26)	9 (29)	87 (59)	114 (114)

n = Searches in W.R.U. Mechanised Search System

(n) = Searches in Facet Index

Post-search evaluation of cut-off decisions showing the numbers of search requests that fall into the six possible categories of cut-off type and performance, derived from data in one particular operational test[3].

Table II

DISCUSSION

Mr A. E. Cawkell (Consultant to Institute for Scientific Information) said he would be interested in the comments of Cheney and Keen concerning certain items of importance in SDI systems. These had become evident from experience obtained in a large, commercially available system, but did not seem to have been emphasized in the previous papers.

Firstly, the compiling of the profile, followed by appropriate feedback was of particular importance. Only if this was properly done could the potential of the system be properly realized. In this connection, one aspect had so far received no attention in the session: the manageability of the information sent to the weekly subscriber. If the profile was too broad, the subscribing scientist might receive an unmanageably large amount of information. Alternatively, if the profile was too specific a number of relevant papers might be missed. Usually the weekly print-out would contain 'hits', 'grey' information (may or may not be relevant), and 'noise'. Furthermore the subject might be one in which there was a small or large amount of activity, with a correspondingly small or large amount of published information. Appropriate control in these matters might be applied by profile consideration and feedback and in practice some compromise could usually be reached without great difficulty.

Secondly, system protaganists were never very specific about their costs. Running costs were usually given, but a veil was drawn over the costs of preparation. Unless there was a large number of subscribers, the amortization costs per running hour were likely to be heavy. Costs for systems evolved in certain environments (present protagonists on the platform excepted) were not noted for realism in the matter of overheads, and the small/medium organization would do well to consider participation in an existing system before embarking on its own.

Finally, the matter of timeliness: the preferred method of building up the data bank seemed to be to feed in a relatively small amount of essential information per document culled from it with a minimum amount of intellectual effort, so that a large number of documents might be covered. This procedure brought with it the possibility of minimizing the time interval between document publication date and subscriber's reading date

Mr Cheney said that compiling profiles was time-consuming, and a lot of attention had to be given to it. They found that about 6 per cent of their users already knew of the papers that they sent them. A lot of the work was done 'out of hours'. The computer was on site and very elastic—it would be costlier not to use it.

Mr Anthony said they had made an analysis and found it was easier to get results from a small system than from a large one.

Mr Cawkell said that if the subscriber was working in a narrow discipline then some of the information received in his print-out might relate to papers already known to him, although it was likely that this information would often be received faster via an SDI system than through other channels. In the case of the subscriber who was working in a wider subject, perhaps one in which activities spread into a number of disciplines, it was less likely that he would be able to cover all possible information sources.

Mr B. T. Stern (B.I.P. Chemicals) said that since the system described in the paper involved the scanning of journals for relevant articles that were to be included in the system, one might expect relevance to be 100 per cent. What was perhaps being measured was the efficiency of the pre-selection, i.e. the memory of the person scanning journals at the input stage.

Mr Cheney said the preliminary scanning was cursory and not time-consuming. In time they hoped the relevance would approach 100 per cent.

Mr Anthony explained that the relevance ratio was calculated on the basis of the number of relevant articles each user received, and not against the total number in the system. There were variations between subjects and between people.

Mr C. W. Cleverdon (College of Aeronautics, Cranfield) said that it was unwise to generalize by saying that too many papers were retrieved by mechanized searches. High discrimination was possible, but the more important aspect was the requirements of the user, for some users required and accepted a large output.

Mr A.H.Holloway (NSTIC) said that the concentration on search strategy led to conclusions which were valid for the particular environment, but might well not be valid for another, as for a sufficient input or indexing programme.

Secondly, the avoidance of intellectual effort appeared to be impracticable as such: was it not the case that the question was one of switching its position between the indexing stage, the request stage and the planning stage, at which the manager might endeavour to devise a system in which the intellectual effort in indexing and retrieval was minimized?

Mr Keen said he agreed. In his paper he had tried to concentrate on strategy divorced from the environment, as an abstract intellectual exercise. In an operational situation the environment would have to be considered, and the users' requirements were the most vital.

Letters to the Editor

LOGIC OF CO-ORDINATE INDEXING

Dear Sir,

As one of the founders of the Co-ordinate Indexing Group, I fully support Miss Lewis's question (November, p.387) as to how much of Mr Jolley's terminology is necessary in this field. Specialist terminology transferred from one field to another without any real necessity degenerates into jargon—or name-dropping. Since the people who have pioneered the most successful form of co-ordinate indexing managed to do so without such terminology and since those of us who followed them managed to learn the elegantly simple principles without recourse to it, it is reasonable to ask whether Mr Jolley could not avoid its propagation and Aslib its publication.

Yours faithfully,
R. MOSS.

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17 Cragside,
Thackley,
Bradford.
4th December 1967.

Dear Sir,

I am grateful to Mr Jolley for replying to my letter, but the real point remains unanswered.

That the terms used by him are standard ones is not in question—although such is the speed of change in education and science that adults will not inevitably be familiar with those found in school textbooks. Also the standard terms of one discipline can well become esoteric jargon when applied to another. But perhaps I might clarify my real complaint with an example. Take a straightforward syllogism:

All people are bipeds,
All Chinamen are people,
Therefore All Chinamen are bipeds

This sequence of statements all can follow. But, in logical terms it can be played about with in a number of ways. The statements are all called 'universal affirmatives'. Each can be represented by A, and to remember that there are are three, A+A+A, a meaningless mnemonic can be employed, e.g. Barbara. The words 'people', 'bipeds' and 'Chinamen' are called variables, and can be symbolically represented by P, B and C, and the sequence becomes:

All P are B
All C are P
∴ All C are B

The whole thing can also be shown graphically in the form of three concentric circles—B enclosing P enclosing C.

This so far is elementary, but one can go on—and on. What I hope to convey is the way in which simple statements, originally obvious to all, can, by the use of terms and symbols be made increasingly obscure until only the specialist will understand, although it does not advance the original idea. This is an attractive intellectual exercise, but how many Aslib members, in the course of their daily routine, need to bother with it? However, if these abstractions are part of a future pattern, then I hope all entrants to the profession are warned that a knowledge of advanced mathematics will be more useful to them than the presently accepted library techniques.

Yours faithfully,
MISS V. LEWIS.

Technical Library,
Lloyd's Register of Shipping,
71 Fenchurch Street,
London EC3.
5th December 1967.

Dear Sir,

I have just read Mr Jolley's answer to Miss Lewis on his choice of vocabulary in his paper on co-ordinate indexing, and I realize I have another item to be thankful for this Christmas—that I am not fourteen years old and doing maths. I cannot remember many of these awful words being used in *my* textbooks, even when I qualified in one of the 'major sciences' mentioned by Mr Jolley (Architecture). I at last resign myself to being really square, if we are still allowed to call a figure of four equal sides at right angles to each other by this name. I have the deepest admiration for the present younger generation, and only hope I can keep up sufficiently for ordinary communication till death us do part, and it will not really come to the words of Messrs Flanders and Swann 'H_2O to you Professor, and the reciprocal of pi to your dear wife' instead of a happy New Year to you all.

Yours faithfully,
PATRICIA SPILHAUS.

Barton Cottage,
Colenso Road,
Newlands, Cape.
20th December 1967.

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Applications are invited for the post of senior assistant in the Library. Candidates should have some experience in a special library and a professional qualification; knowledge of languages would be an advantage. Starting salary in the range £932–£1,189 p.a. Apply, in writing, to the Director, Aslib, 3 Belgrave Square, London SW1.

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CHEMICAL ABSTRACTS, Vol.39, 1945, to Vol.63, 1965. Complete, including decennial indexes Vol.41–50. All bound to end of Vol.50. Offers to the Chief Librarian, The English Electric Co Ltd, Whetstone, Leicester, LE8 3LH.

CALCUTTA UNIVERSITY CENTRAL LIBRARY

ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 **February 1968** **Number 2**

ASLIB CALENDAR 1968

February

THU. 8–FRI. 9	Course on Business information.
TUE. 20	Evening meeting—'Many questions', by Mrs E. Mack.
TUE. 27–WED. 28	Course on work with patents.

March

WED. 6	Chemical Group annual general meeting.
MON. 11 – THU. 21	Senior Introductory Course to special library and information work.
THU. 21	Afternoon meeting. 'The computer: what it is and what it can do', by Miss A. Chilton, Senior Lecturer, Birmingham College of Commerce.
FRI. 29	Scottish Branch annual general meeting and Conference.

April

FRI. 5 – SAT. 6	Transport/Aeronautical Groups joint conference.
MON. 8 – TUE. 9	Course on Business Information.
TUE. 23	Second Aslib Annual Lecture. 'The two cultures in information work', by Sir Frank Francis.

May

WED. 15	Advanced Course on Patents: Opposition.
THU. 23	Evening meeting. 'Patent agents' work for industry', by Mr J. A. D. Cropp.

June

FRI. 21–SUN. 23	Electronics Group annual conference.

September

SUN. 22–WED. 25	42 Aslib Annual Conference, University of Kent, Canterbury.

The computer: what it is and what it can do

Miss Aimée Chilton, Senior Lecturer-in-Charge of Data processing Facilities at Birmingham College of Commerce, will lecture on the computer, beginning at 3 o'clock on Thursday 21st March, at the Royal Aeronautical Society, 4 Hamilton Place, London W1 (nearest tube station is Hyde Park Corner; buses: Piccadilly, Knightsbridge or Park Lane).

Mr. Keith Davison, Senior Systems Analyst of ICT, Reading, formerly senior lecturer at the Birmingham School of Librarianship, will take the chair. Tea will be served at 3.45 p.m. and the meeting will close at approximately 5.30 p.m.

We wish to emphasise that Miss Chilton's talk is aimed at explaining in the most elementary way just what a computer can and cannot do; discussion will be kept at a level appropriate to an audience wishing to start from scratch, but senior, experienced users of computers will be welcome if they come prepared to help by explaining and sharing experience with newcomers and would-be users in the very simplest of terms. There will be no sophisticated discussion. Even discussion on library applications of computers will be kept at an elementary level.

Please inform the Meetings Organizer, Aslib, if you plan to attend.

Second Aslib Annual Lecture

As members will have noted from the January issue of *Aslib Proceedings,* the Second Aslib Annual Lecture will take place on 23rd April 1968 at the William Beveridge Hall, Senate House, University of London, and admission is to be by tickets. Application forms are being distributed with this issue and tickets will be sent on application to: The Meetings Organizer, Aslib, 3 Belgrave Square, London SW1.

Clearing House for Non-conventional Teaching Materials

The Association of British Library Schools has been invited by Aslib to participate in an FID scheme to obtain information on sources of materials for teaching librarianship and information science. Messrs Davinson and Revill at Leeds School of librarianship have been asked by ABLS to undertake the British section of this international survey. It is hoped that some kind of central clearing house for the exchange of ideas, information, and possibly, actual materials can be established. To this end City University and Hatfield College of Technology have been approached and have expressed an interest. An approach has also been made to all the schools of librarianship, and a questionnaire is being completed by each.

It is realized that many libraries have well-developed in-service training schemes. A great deal of non-conventional teaching material may well have been prepared for such courses (e.g. case studies, in-tray exercises, slides, transparencies, facsimiles, films, tapes, charts, role-playing exercises, programmed texts, business games, etc.). Should any librarian wish to co-operate and be prepared to inform the organizers of his holdings, he will be kept informed on the progress of the scheme. Please write to Messrs Davinson & Revill, Department of Librarianship, 28 Park Place, Leeds 1, for further details.

Bachelor's degree in Library Science

The University of Wales has given approval in principle to a Bachelor's degree in library science at the College of Librarianship Wales at Aberystwyth. This will be a joint honours degree in library science and one other subject and will be offered in conjunction with the University College of Wales, Aberystwyth. This is the first degree of its kind in Britain, although it has become possible in recent years to offer librarianship as a subject in arts and science degrees at some other universities.

At present the College of Librarianship Wales, founded in 1964, has over 300 students (including seventy post-graduates) studying for the professional examinations of the Library Association.

It is expected that the degree course will begin in October 1968. Further information may be obtained from the Principal, College of Librarianship Wales, Llanbadarn Fawr, Aberystwyth, Cardiganshire.

Medical Librarianship

It is proposed to hold a Workshop on Medical Librarianship at the Leeds College of Commerce from Monday 22nd to Friday 26th April 1968. This is intended for librarians in universities, colleges, public libraries, hospitals, etc., who are familiar with the techniques of librarianship, but who now wish to gain an understanding of the bibliography and librarianship of medicine. The course will be of a practical nature and will include sessions on medical bibliography; administrative problems in medical libraries; and the cataloguing, classification and indexing of medical material. There will also be a series of lectures on 'Current trends in medicine' to be given by Dr K. Schwarz (Department of Public Health and Preventive Medicine, Leeds University).

The fee will be approximately £10 (excluding accommodation). Full details will be available within the next few weeks and these may be obtained from Mr D. Daintree, FLA, Department of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1.

Classification of Library Science

The following note has been received from Mr C. D. Batty, Senior Lecturer, College of Librarianship Wales.

The CRG Library Science Classification[1] is a faceted scheme of the kind now used for many special subject areas. It covers all types of libraries and library services and the materials and techniques of librarianship as well as general questions affecting the profession and a wide variety of fringe topics from education to the book trade. The classes in the scheme are facets of library science and they are listed in the schedule in general to specific order: general topics; processes; materials, departments and services; kinds of libraries. Class numbers for documents are thus built up by combining elements of description from these facets where necessary in an order of priority (in practice the reverse of the schedule order) which assembles the ideas in the most significant and useful order. The notation of the core schedules is alphabetical and the combination of elements is indicated by the initial capital letter of each facet's notation. The notation of the fringe schedules is numerical and there is provision for the use of UDC for extending the detail of these schedules and for introducing topics outside the scope of these schedules.

The scheme was worked out in its draft form by the Classification Research Group in London and its first practical application was in the library of the College of Librarianship Wales beginning in March 1965 actually before publication of the preliminary draft edition. It was also used as a teaching tool in courses in classification and information retrieval and has formed part of the experiential training model in documentation developed in the College's Department of Information Retrieval Studies.[2] After more than a year's experience with the scheme the College began to circulate the bulletin CRG/EXTRA (EXTensions, Revisions, and Alterations) to outline problems encountered and solutions proposed. It is hoped in this way to secure comment and discussion and use to interest the Classification Research Group and all interested parties in the work on a second edition. The Library Association in London is now understood to be considering the use of the CRG scheme for its library, and other library schools in England are known to have used the scheme in their courses in classification.

[1] CLASSIFICATION RESEARCH GROUP. Classification of library science: preliminary draft edition. London, Aslib, for the C.R.G., 1965. (Out of print.)

[2] BATTY, C. D. A documentation training model. *American Documentation*, vol. 18, no. 3, July 1967.

Program

Program, the quarterly periodical which for the past eighteen months has been reporting on developments in the use of computers in British university libraries, is shortly to extend its coverage. Beginning with volume 2, no. 1, April 1968, all kinds of libraries will be included within its scope and the sub-title will be changed to *News of computers in British libraries.* This is being done partly as a result of a direct request from the Library Association's Library Research Committee, and partly in view of the widespread and growing interest in the present periodical.

The subscription rate will be 25*s* a volume with a special student's rate of 10*s*. Orders and contributions should be sent to the Editor, Richard T. Kimber, Queen's University School of Library Studies, 2 College Gardens, Belfast, Northern Ireland, BT9 6BQ. Cheques should be made payable to the Queen's University of Belfast.

Joint Library Automation Project

The libraries of Southampton and Loughborough universities have received grants totalling £34,500 from the Office for Scientific and Technical Information for a three-year joint project on the development and testing of automated library processes.

This project will be based on work already in progress or planned at Southampton and Loughborough, and systems evolved are to be capable of common application at both universities, and sufficiently flexible to allow adaptation to the needs of other libraries.

Southampton has already put into operation a Circulation Control System, using automatic data collection equipment to provide paper tape input to the University's ICT 1907 computer, and will develop this system for on-line file inquiry and updating. In addition a comprehensive acquisition and cataloguing system linked with the use of bibliographic data to be made available on magnetic tapes from the British National Bibliography–Library of Congress 'Marc' project will be designed and implemented.

At Loughborough, using the University's ICT 1905 computer, investigations will include further development of an alphabetical subject index to classified catalogues, a periodicals holdings system, and the problems of cataloguing and handling research reports and pamphlets. Testing of 'Marc' tapes from the subject approach will be carried out.

It is intended that systems developed at each university will be checked and tested at the other. The grant has been made primarily to enable each of the university libraries to appoint staff to carry out the large programme of systems design and programming involved in this project. Progress reports on the work will be issued regularly and made generally available.

Geological data retrieval

OSTI has awarded a grant of £34,725 over a period of three years to the Sedgwick Museum in the Department of Geology, University of Cambridge, for the development of a storage and retrieval system for geological data. The project, under the direction of Professor H. B. Whittington, aims to produce a set of computer programmes for the maintenance and use of files on geological data. In the first instance the programmes will be intended for files of up to about 108 characters on specimen-associated data and the production of catalogues and indexes from such files.

Programming started in October and it is hoped that the initial suite of programmes will be ready for evaluation by the end of 1968.

Food documentation

The Commonwealth Agricultural Bureaux (CAB) consider that a specialized information service is required for food science and technology and as a first step are planning to introduce a new abstracts journal in 1969. The journal will be the basis of an international food documentation service which will be provided by the Commonwealth Agricultural Bureaux, the Institute for Documentation Science in Germany and the American Institute of Food Technologists acting in collaboration. The Commonwealth Bureau of Dairy Science and Technology will be mainly responsible for producing the journal, which will be printed in Germany by computer-controlled typesetting, and the Institute for Documentation Science will be responsible for storing the information on magnetic tape for the generation of the indexes and for information retrieval.

Mr E. J. Mann, Director of the Bureau, has produced a survey of the world's food literature, and OSTI has awarded a grant of £7,500 to CAB so that a full feasibility study can be carried out.

Biodeterioration

During the past two years Dr H. O. W. Eggins of the University of Aston has developed a Biodeterioration Information Centre with support from both the University and OSTI. The Centre has a collection of 2,500 articles, selected by specialists in more than thirty countries and indexed for searching with a 'peek-a-boo' card system. The following services are now available to scientists and technologists throughout the world:

The *International Biodeterioration Bulletin*, publishing original papers and critical reviews.

IBBRIS, a quarterly classified bibliography, listing the recent acquisitions of the Centre which at present amount to 2,500–3,000 articles a year.

A photocopy service for inaccessible literature, Government reports, etc.

A question-answering service, which provides either *IBBRIS* accession numbers or, when available, author abstracts of articles in the collection.

Further details of these services can be obtained from the Biodeterioration Information Centre, Department of Biological Sciences, University of Aston, Gosta Green, Birmingham 4.

National Referral Center

Although the National Referral Center for Science and Technology in Washington has been operating since 1962, questions asked at the 1967 Aslib Annual Conference suggested that many members would like to have more detailed information about its method of operation. This information is given in a brochure entitled *National Referral Center for Science and Technology*, a copy of which has recently been received at Aslib and is available from the Library. (See also *Aslib Proceedings*, vol. 16, no. 8, p. 258–68.)

IEE Colloquium

A colloquium entitled 'Developments towards a computer-based information service in physics, electrotechnology and control' will be held at the IEE at 2.30 p.m. on Tuesday 27th February 1968. Further details and application forms may be obtained from the Institution of Electrical Engineers, Savoy Place, London WC2.

REVIEW

ADLER, MAX K. *Directory of British market research organizations and services.* 2nd edition. London, Crosby Lockwood, 1967. 84p. 30*s*.

This is the second edition of a directory originally published in 1965. The major differences between the editions are that the market research facilities section has been subdivided into consumer and industrial market research; the name of the most responsible person in each firm is now given and a list of these names appears at the end, although there are some spelling discrepancies; the glossary of terms has been dropped in the second edition.

There is no list of possible headings to be consulted in the services section and, although several subjects are under both consumer and industrial market research, no page heading tells the reader if he is looking at the wrong one.

In the organizations section each company is permitted to list ten services it offers in both fields of market research.

Many more firms are listed in the second edition, but it is surprising how many of those in the first edition are not mentioned at all. There is no indication of what has happened to these: presumably some have been taken over, but by whom? And some have changed their name—but to what? It would be useful to know of any connection between companies—one particular firm has exactly the same director, address and telephone number as another. It would also be helpful to know the name of parent or subsidiary companies, particularly when an advertising agency is concerned.

There is no attempt at any indication of the size, volume of business, or standing of the firms. If in doubt about which one to approach, the author suggests approaching a consultant; there are twenty-eight firms listed under consumer market research consultants, and thirty-three under industrial market research consultants.

FID

The 34th Conference of FID will be held this year in Moscow, from Monday 9th to Saturday 14th September and will be organized by the All-Union Institute for Scientific and Technical Information (VINITI). This will be followed by the International Congress, from Monday 16th to Wednesday 18th September, the theme of which will be: National and informational information service systems and their role in scientific and technical progress.

The three Congress sessions will be concerned with:

1 National and international information systems and evaluation criteria for information systems.
2 Software for processing of scientific information systems.
3 Hardware for processing of scientific information.

Those wishing to contribute papers to the Congress should submit them before Wednesday 1st March.

Computer-based Information Retrieval Systems

A two-day course to be held at the Liverpool College of Commerce on Thursday 18th and Friday 19th April is designed to give anyone who is active or interested in the field of information work a conspectus of the major operational programmes and feasibility tests being conducted in the United Kingdom. Lectures will be given by Dr G. A. Somerfield, Dr A. J. Harley, Mr A. E. Cawkell, Mr E. J. Coates, Dr A. H. Kent and Mr P. M. Clague.

Further information may be obtained from the course organizer: Mr Bernard Houghton, School of Librarianship, College of Commerce, Tithebarn Street, Liverpool.

BP'S EXPERIENCE WITH A COMPUTER-BASED INFORMATION SYSTEM

G. W. THOMAS *and* P. H. SCOTT
BP Research Centre, Sunbury-on-Thames

Presented at a meeting of the Aslib Chemical Group, Wednesday 29th November 1967

Introduction

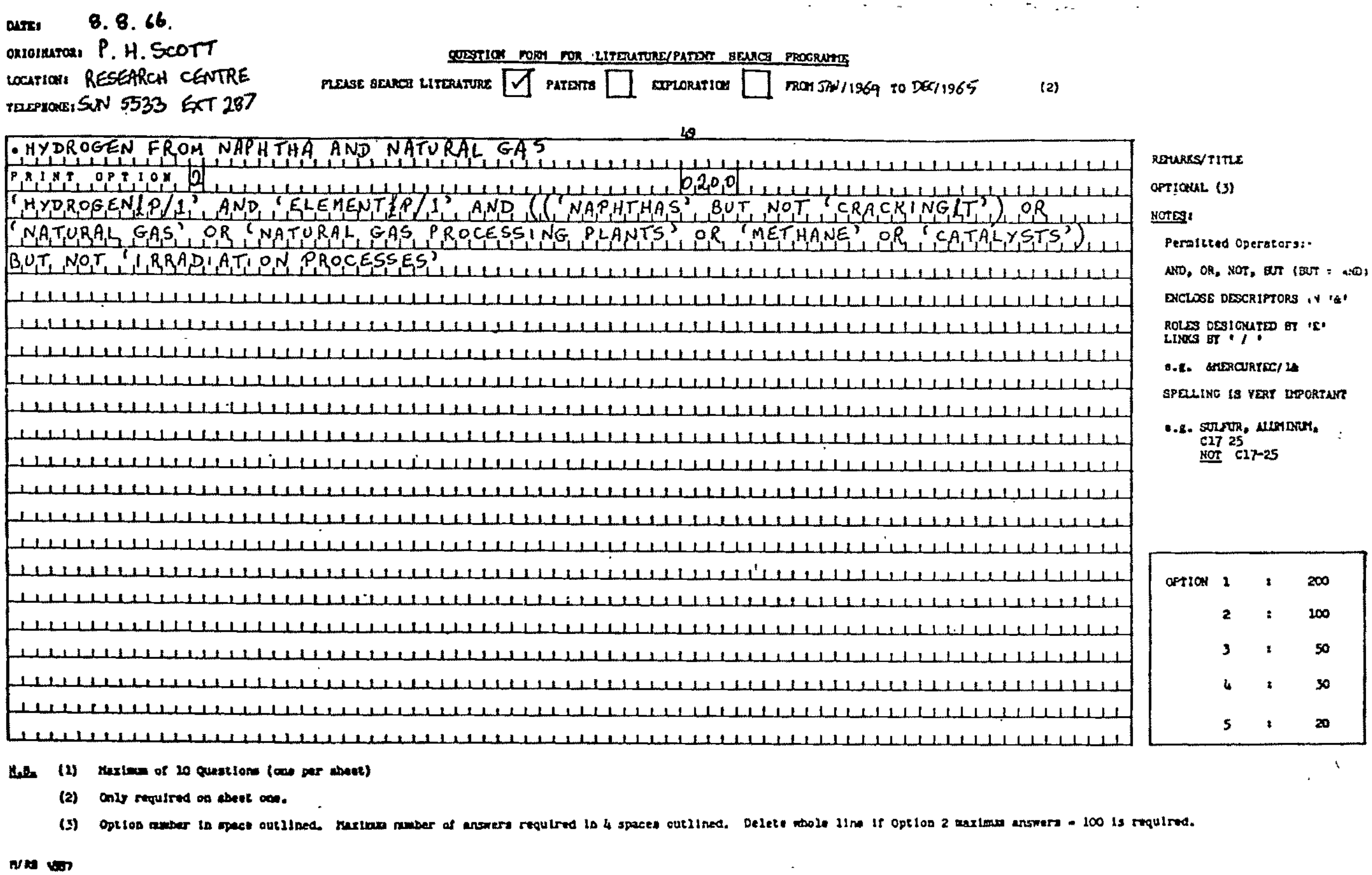
SINCE 1962 The British Petroleum Company Limited has been subscribing to the American Petroleum Institute's (API) *Abstracts of Refining Literature.* This service, which provides abstracts in both bulletin and card form from a wide range of petroleum and petrochemical sources, proved extremely useful, and rapidly became the basis for the General Information Service at the BP Research Centre, Sunbury. Because of this, when the API decided that from 1964 onwards their abstracts would be indexed by a computer-based co-ordinate indexing system, it was agreed that we would attempt to make as full a use as possible of the new facilities offered. This paper is a record of our attempts to use two aspects of the system—searching by computer, which involves the use of an IBM 1401, and preparing a computer tape from our own indexing, using a 1401 and a 7094.

Before we get down to details, it might be best to give a broad picture of the material provided by the new system. In addition to the file cards and bulletins already mentioned, six different items are supplied:

1 The *Dual Dictionary.* This is a conventional co-ordinate index, in which under each descriptor the corresponding abstract numbers are arranged in ten columns, according to final digit, to facilitate matching in searches. It is useful for exhaustive searches, but not for browsing.
2 The *Alphabetical Subject Index,* or ASI. This index lists the titles and numbers of related abstracts under each descriptor. It is useful for general searches, and browsing.
3 The *Bibliographic Index.* This is a list of the bibliographic references to all the items in the system, arranged in numerical order. It is printed at the end of the ASI.
4 The *Author Index.* This is issued as a separate index.
5 The *Computer Search Tape.*
6 The *Subject Authority List,* or thesaurus.

Search results

The fundamental product of the API indexing system is the master computer tape. Not only does it serve as a source for all the manual indexes, but it can also be used directly for literature searches. We will first of all describe the way



DATE: 8. 8. 66.
ORIGINATOR: P. H. SCOTT
LOCATION: RESEARCH CENTRE
TELEPHONE: SUN 5533 EXT 287

QUESTION FORM FOR LITERATURE/PATENT SEARCH PROGRAMME

PLEASE SEARCH LITERATURE ☑ PATENTS ☐ EXPLORATION ☐ FROM JAN/1964 TO DEC/1965 (2)

49

•HYDROGEN FROM NAPHTHA AND NATURAL GAS

PRINT OPTION 2 0200

'HYDROGEN£P/1' AND 'ELEMENT£P/1' AND (('NAPHTHAS' BUT NOT 'CRACKING£T') OR
'NATURAL GAS' OR 'NATURAL GAS PROCESSING PLANTS' OR 'METHANE' OR 'CATALYSTS')
BUT NOT 'IRRADIATION PROCESSES'

REMARKS/TITLE

OPTIONAL (3)

NOTES:

Permitted Operators:-

AND, OR, NOT, BUT (BUT = AND)

ENCLOSE DESCRIPTORS IN '&'

ROLES DESIGNATED BY '£'
LINKS BY ' / '

e.g. &MERCURY£C/1&

SPELLING IS VERY IMPORTANT

e.g. SULFUR, ALUMINUM,
C17 25
NOT C17-25

OPTION 1	:	200
2	:	100
3	:	50
4	:	30
5	:	20

N.B. (1) Maximum of 10 Questions (one per sheet)
(2) Only required on sheet one.
(3) Option number in space outlined. Maximum number of answers required in 4 spaces outlined. Delete whole line if Option 2 maximum answers = 100 is required.

R/RS [illegible]

FIG. I

that a question is prepared for the computer and the nature of the print-out which may be obtained, and then review some of our own experience with the system and the lessons we have learned from it.

Figure 1 shows one of the question forms devised by our computer department for computer searches. In the first line, which is marked with an asterisk, the search title is written. The print option, in the second line, controls the form of the print-out; it will be discussed in more detail later. The rest of the form consists of the search formulation.

The API System uses a controlled vocabulary, and therefore the first stage in the preparation for a computer search is to convert the question, which will have been expressed in the inquirer's own natural language, into the language of the Subject Authority List. The resulting descriptors are then linked by one or more of the permitted operators AND, OR, NOT, or BUT. A question on the chromatography of aldehydes could, for example, be phrased as

'CHROMATOGRAPHY' AND 'ALDEHYDE'

The quotation marks indicate that the word or words enclosed by them constitute a descriptor. Brackets can also be used in formulating search questions; they have the same significance as in an algebraical equation. Thus we might have

('POLAROGRAPHY' OR 'CHROMATOGRAPHY') AND
('KETONE' OR 'ALDEHYDE')

The print-out may be varied in both form and quantity by means of the print option statement on the second line of the search form. This statement consists of two numbers: the first number, which varies from 1 to 5, determines the format of the print-out, and the second, which may take any value, stipulates the maximum number of answers required. With regard to format, if print option 1 is specified the computer will print out a list consisting solely of the numbers of relevant items; print option 2 produces not only numbers but also full bibliographic details of the documents; print options 3 to 5 add to these details a varying selection of the descriptors used to index the documents. The print option most frequently used is No. 2.

We shall now describe some actual searches which we have made with the computer and hope that these will illustrate some of the features and pitfalls of the system.

One of our first trial searches was an attempt to find information on the possible relation between the acidity and activity of silica-alumina catalysts. The search formulation that we used was as follows:

'PH' AND 'ACTIVITY' AND ('ALUMINA£C' AND 'SILICA£C') OR
'CATALYSTS'

This, we thought, was really rather subtle, since we should retrieve not only information specifically on the acidity and activity of silica-alumina catalysts but also information on the acidity and activity of catalysts in general, some of which might well be relevant to our search. (The £ symbols at the end of ALUMINA and SILICA indicate that the letter following is a role indicator, in this particular case the indicator for a catalyst.)

The resulting print-out, however, contained a high proportion of material which had nothing to do with acidity, activity, alumina, or silica; its sole relevance to the question was that, at some point in the documents retrieved, catalysts were mentioned. At this point we remembered, somewhat belatedly, that in a question formulation, association is to the left; in other words, the formulation

'X' AND 'Y' OR 'Z'

is interpreted by the computer to mean

('X' AND 'Y') OR 'Z'

In our particular case, the computer had interpreted the question as a request for either any information on the acidity and activity of silica-alumina catalysts, or for any information on catalysts, and that, in fact, was what it had produced. Our formulation should have been either

'PH' AND 'ACTIVITY' AND (('ALUMINA£C' AND 'SILICA£C') OR 'CATALYSTS') or

'CATALYSTS' OR ('ALUMINA£C' AND 'SILICA£C') AND 'PH' AND 'ACTIVITY'

This search thus taught us three important lessons:

1 Association is always to the left.
2 When in doubt, use brackets.
3 Over-subtlety does not pay.

In another search, we were trying to retrieve material on hydrogen production. Our formulation was:

'FORMATION' AND 'HYDROGEN£P'

It should be explained that in the API vocabulary FORMATION is synonymous with production or manufacture. P is the role indicator for product, and its use in this context serves to eliminate documents on the production of compounds from or by means of hydrogen. The printout was more satisfactory than that obtained from the catalyst search, but there was still a large proportion of irrelevant material, including a number of documents on the production of ammonia. To understand the reason for this, we must consider the way in which chemicals are indexed under the API system. Every inorganic compound is indexed not only under its own name but also under the names of all its constituent elements. Thus ammonia is not only indexed as AMMONIA but also as NITROGEN and HYDROGEN. To prevent mis-matching and the consequent false drops, each chemical compound in a given document is given its own link number, and this number is also given to all the constituent elements. Since any document indexed with the descriptor AMMONIA will also have the descriptor HYDROGEN, it can be seen that our formulation

'FORMATION' AND 'HYDROGEN£P'

would retrieve documents not only on hydrogen production, but also on the production of ammonia, or, in fact, any inorganic compound containing hydrogen. To avoid this, the question was re-formulated as

'FORMATION' AND 'HYDROGEN£P/1' AND 'ELEMENT£P/1'

The search could now only retrieve material on the production of elemental hydrogen. It is interesting to note that while the original search produced 42 per cent of useless material, a second search using the new formulation only produced 4 per cent of useless material.

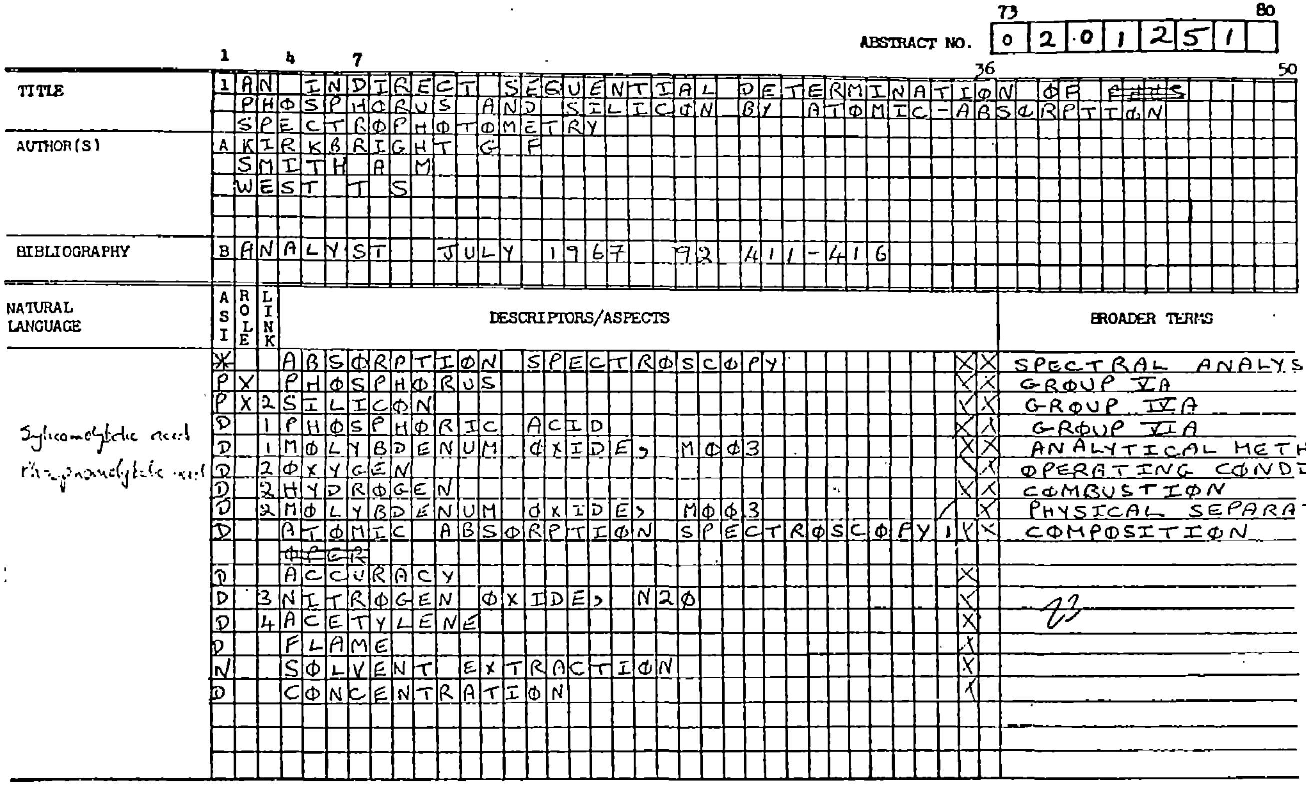
To describe all the searches we have made in detail would be tedious and would serve little useful purpose. We may summarize by saying that over the past two years we have made some twenty-five searches; of these, only five gave an overwhelming proportion of false drops. The majority of the searches were either deliberately constructed to test some aspect of the system or else used to confirm the results of manual searches. Our worst result was obtained with the silica-alumina search described in our first example; our best result was obtained with a search which, strangely enough, was on a closely related topic, and produced 99 per cent useful material.

One last point is concerned with false drops. We do not, in general, consider false drops to be a very serious problem; it is difficult to eliminate them entirely, and attempts to devise formulations that will do so may well also succeed in eliminating relevant material. Nevertheless, it is clearly inefficient to have the computer print out a large volume of irrelevant material when this can be easily avoided. For a simple, clearly defined search this is no great problem, but a more complex question may require a more complex formulation. Now we may re-state Murphy's Law as 'If there is any way in which the computer can possibly misinterpret a search question, this is the way in which the question will be interpreted'. In such cases, we have found that the safest course is to take the manual indexes (dual dictionaries) and work through the search formulation over a very small portion of the material to be covered. This need only take a few moments, but the results may reveal unsuspected flaws in the search formulation which could give rise to waste of time and money. Since the computer used for searching is the IBM 1401, which costs £40 an hour to run, and since on the average each question takes twenty minutes per year of tape searched, attempts to reduce costs are of importance.

Input

It has been well said that 'the cleverest conjuror in the world cannot produce a rabbit out of a hat unless there is already a rabbit in the hat'. However skilled our search procedures, they will be pointless if we have no material to search. Most of our material is, as already stated, supplied by the API. The API's coverage is wide; nevertheless, there are still journals and other sources which they do not abstract. At the BP Research Centre, we provide a supplementary abstracting and indexing service to deal with this type of material, and also with our own internal reports and technical memoranda. We index the documents in line with the API and, although we have an optical coincidence system for manual retrieval of information, we intend to produce our own computer tapes which may be used for searching and also for the generation of printed indexes. At the time of writing, we have made considerable progress in this direction; a description of the methods we have used and the difficulties we have encountered may be of interest.

The first stage in the production of a computer tape is the transfer of the indexing data from the indexing worksheets to IBM 80 column punched cards. Our first attempts to design an indexing worksheet, while quite satisfactory for the manual indexing system, proved difficult for the punched card operators. Figure 2 shows the final version. The sections of the worksheet which are divided into squares are the sections which need to be punched; the rest is



73 80
ABSTRACT NO. 0 2 · 0 1 2 5 1

1 4 7 36 50

TITLE
1 AN INDIRECT SEQUENTIAL DETERMINATIØN ØF ~~[illegible]~~
PHØSPHØRUS AND SILICØN BY ATØMIC-ABSØRPTIØN
SPECTRØPHØTØMETRY

AUTHOR(S)
A KIRKBRIGHT G F
SMITH A M
WEST T S

BIBLIOGRAPHY
B ANALYST JULY 1967 92 411-416

NATURAL LANGUAGE	ASI	ROLE	LINK	DESCRIPTORS/ASPECTS			BROADER TERMS
	*			ABSØRPTIØN SPECTRØSCØPY	X	X	SPECTRAL ANALYSIS
	P	X		PHØSPHØRUS	X	X	GRØUP VA
	P	X	2	SILICØN	X	X	GRØUP IVA
	D		1	PHØSPHØRIC ACID	X	X	GRØUP VIA
Sylicomolybdic acid	D		1	MØLYBDENUM ØXIDE, MØØ3	X	X	ANALYTICAL METHØD
Phosphomolybdic acid	D		2	ØXYGEN	\	X	ØPERATING CØNDITIØN
	D		2	HYDRØGEN	X	X	CØMBUSTIØN
	D		2	MØLYBDENUM ØXIDE, MØØ3	/	X	PHYSICAL SEPARATIØN
	D			ATØMIC ABSØRPTIØN SPECTRØSCØPY 1	X	X	CØMPØSITIØN
				~~ØPER~~			
	D			ACCURACY	X		
	D		3	NITRØGEN ØXIDE, N2Ø	X		
	D		4	ACETYLENE	X		23
	D			FLAME	X		
	N			SØLVENT EXTRACTIØN	X		
	D			CØNCENTRATIØN	X		

FIG. 2

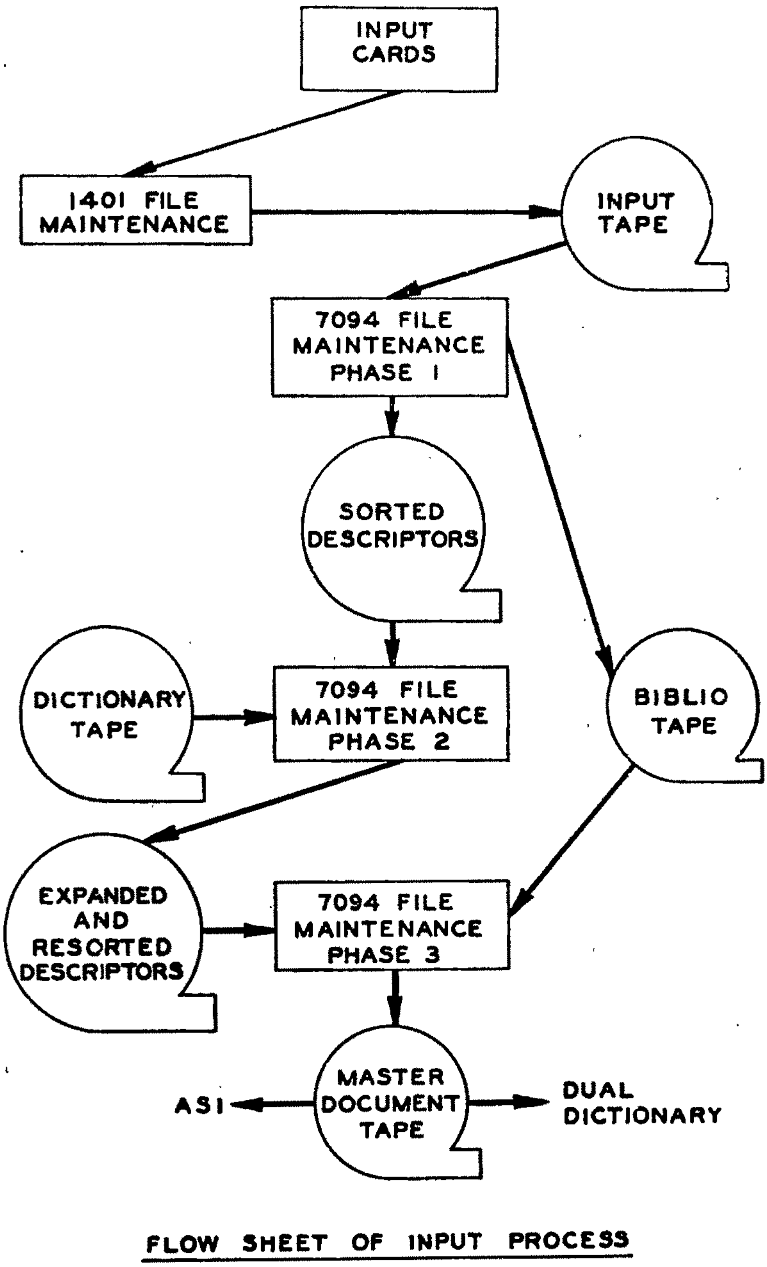

INPUT CARDS
1401 FILE MAINTENANCE
INPUT TAPE
7094 FILE MAINTENANCE PHASE 1
SORTED DESCRIPTORS
DICTIONARY TAPE
7094 FILE MAINTENANCE PHASE 2
BIBLIO TAPE
EXPANDED AND RESORTED DESCRIPTORS
7094 FILE MAINTENANCE PHASE 3
ASI
MASTER DOCUMENT TAPE
DUAL DICTIONARY
FLOW SHEET OF INPUT PROCESS

FIG. 3

purely for the benefit of the manual system. The upper section of the worksheet requires no comment; in the lower section, the descriptors are entered, each with its appropriate link, role, and ASI designation. The latter is a symbol which indicates how the term in question is to be handled in the production of the Alphabetical Subject Index. Roles and links are optional, but the ASI designation is obligatory. For the descriptors, correct spelling is essential, and in this context correct spelling means spelling which is in accordance with the API Subject Authority List. In order to avoid possible mis-readings, the letter I is always barred, the letter O is always slashed, and the figure 7 is always written in the continental fashion. Terms broader than the descriptors used are automatically posted on to the tape during computer processing; they are written in here purely for the benefit of the manual system.

Despite all the care which is taken, some punching errors will inevitably occur, and the next stage in the process is to have the punched cards listed and interpreted. This means that they are subjected to a simple computer operation which produces a printed list of the contents of each card, and at the same time the contents of each card are printed across the top of the card itself. The lists are checked against the original worksheets, and any necessary corrections are made. The cards are then ready to be sent to the computer.

Figure 3 shows the way in which the master documents tape is created. The indexing data are first transferred from cards to tape by means of the 1401 File Maintenance program. The input tape thus produced is then processed by the 7094 to give the master document tape. This processing takes place in three stages: in Phase 1, the descriptors are separated from the bibliographical information, which is written on to a separate tape; in Phase 2, the descriptors, which have been sorted into dictionary order, are compared with the dictionary tape and broader and related terms are added; in Phase 3, the expanded descriptor list is recombined with the bibliographic tape to give the master document tape.

A brief account of our experience with the system now follows. The first snag arose with the programs for the 7094 File Maintenance, which would not operate on our computer, and had to be recompiled from the original source decks. The API were very helpful here (as indeed they have been throughout the whole exercise). A list of errors was produced in Phase 2; in this phase the input tape was compared with the dictionary tape, and any documents containing descriptors not in the dictionary were rejected. The length of this list emphasized to us the need for careful checking of the input material to the computer. At the same time, a bibliographic printout was produced showing, in numerical order, the documents which had proved acceptable and had been entered on to the master document tape. When we had made all the corrections required and then compared our list with the bibliographic print-out we received a nasty shock; thirty-one documents had apparently been rejected for no reason whatever!

At this point it should perhaps be explained that there are basically only two reasons why a document should be rejected in Phase 2: excessive length and invalid descriptors. No document record may consist of more than 4,500 characters, including the bibliographic information; this allows the use of just over one hundred descriptors, including automatically posted terms. A quick check on the thirty-one documents showed that they were well within this limit.

The position was thus as follows. We had produced a master computer tape and had shown, by means of a test search, that it could be used as a search tape; however, thirty-one documents had been rejected for no apparent reason. From the master tape we had produced an Alphabetical Subject Index, which was satisfactory apart from the fact that all the abstracts from 1036 to 1170 had been omitted from the main index and had been printed haphazardly at the start of the index. The Dual Dictionary print program also produced a print-out in which the abstracts after 1035 were not correctly treated. The Author Index did not handle multiple entries correctly; where there was more than one author to a paper all the authors appeared as one entry, and there were no separate entries for authors other than the first. In short, everything was working, but nothing was working satisfactorily, and the reasons for the difficulties, to say the least of it, seemed obscure.

A further, more detailed, study of the Computer Manual, however, threw some light on our difficulties. Almost immediately, we solved the mystery of the Author Index. No explicit information was given, but a careful reading of the relevant section enabled us to deduce that every author had to be punched on to a separate card. Similarly, by studying the manual and examining the worksheets for the thirty-one missing abstracts, we became convinced that, despite the absence of error messages, the problem was connected with the length of the relevant document records. They were not over the limit, but they were longer than any of the other documents in the batch, and the longest document of all was No. 1035. It may be remembered that documents of number greater than 1035 were incorrectly handled by the computer. Finally we decided to attempt to insert the thirty-one abstracts on to the tape as 'split' abstracts; this is a technique for dealing with overlength documents. Our attempt was successful, but we still found that the last 135 documents were not being handled correctly; in fact, API have confirmed that the tape which we produced contained the bibliographical details for these abstracts, but no descriptors.

It may be wondered why the thirty-one abstracts were excluded from the original tape, and why we had so much difficulty with abstracts 1036–1170. The reason for this came to light at about the time we were doing the updating run with the split documents. It may be remembered that the programs supplied by the API could not be used on our computer without recompilation. Unfortunately, the programs were recompiled from older material in which the maximum character count had been 2000 instead of 4500. Not only had this caused the thirty-one documents to be rejected, but since 1035 had almost twice the allowable character count, it had effectively obliterated the descriptors for all the following documents. Although this has caused us considerable trouble, this difficulty is unlikely to arise again, and it should be possible to insert the missing data by means of a further updating run.

What have we learned from our experiences with this system? Basically we have learned two things: the first is that all the input material must be checked extremely thoroughly by somebody with a good knowledge of the indexing system, and the second is that one should not be afraid of computers and computer systems. At the start of this exercise we regarded the computer as a black box; punched cards were fed in at one end and (if one was lucky) magnetic tape came out at the other end, but anything that happened in between was comprehensible only to a computer expert. But when we ourselves attempted to learn something more of the system, we were surprised to find how many of the problems could be solved by the application of common sense. So we would advise anyone who is thinking of setting up a computer system to learn as much about computers as possible. The more you can find out about your computer, the better chance you have of getting a really efficient system.

ACKNOWLEDGEMENT

Permission to publish this paper has been given by The British Petroleum Company Limited.

DISCUSSION

Mr McLaren (ERDC) referred to the search for hydrogen production and wondered whether there was any way in which the interference from Ammonia could have been foreseen.

Mr Scott replied that it could have been foreseen from the Thesaurus, but lack of experience at this stage had caused it to have been missed.

Mrs Simpkins (Smith Kline & French) asked how many abstracts were received each year.

Mr Scott said that 14,000–15,000 were received.

Mr Shillingford (ICI) asked about the size of the basic API file, the search costs and whether it was a serial file.

Mr Scott replied that BP had 3½ years on magnetic tape—45,000 abstracts—and that costs on an IBN 1401 were £40 per hour. An average search took twenty minutes/year/tape search. He confirmed that the file was serial.

Mr Eyre (Northwestern Polytechnic) asked whether there were any plans for using an inverted file and whether several tapes could be used simultaneously.

Mr Scott said that while an inverted file was not envisaged at present, it might well become necessary in the future. Only one tape could be run at a time.

Mr Smith (Geigy) asked if the volume of material to be searched would eventually make magnetic tape searching impracticable, and whether there were any plans for disk storage.

Mr Scott did not foresee that this would be a problem in the immediate future; there were no plans for disk storage at present.

Miss Heilpern (BP Trading) asked whether recall had been checked.

Mr Scott emphasised that no detailed mathematical analysis had been made, but it had been established on a qualitative basis that recall was satisfactory.

Dr Carson (Albright & Wilson) asked how many people had been involved in the operations described.

Mr Scott replied that four people had been engaged at different times. Mr Thomas emphasized that his colleague was not working full-time on this work and therefore an accurate estimate of man hours expended was difficult to derive.

Dr Dilke (BP Chemicals (UK) Limited) asked whether only one question at a time could be put to the computer.

Mr Scott said that up to ten questions could be handled simultaneously.

Dr Batten (ICI) asked if the limitations on formulating search questions were clearly defined.

Mr Scott replied that the computer manual listed twelve basic instructions. The most important of these were that not more than ten questions could be handled simultaneously, and that there could be not more than fifty different descriptors.

Mr Nightingale (BP Trading) wondered whether the annual amendments to the API Thesaurus might not cause problems.

Mr Scott explained that the only major differences were between the second and third editions of the Thesaurus, and that formulations had to be submitted for both editions. API were endeavouring to overcome this problem.

Mr Wrigley (Wellcome Research Foundation) asked how many questions were anticipated once the system became operational.

Mr Thomas replied that one to two searches a week were anticipated.

Mr Shaw (Unilever) referred to the problem which had been encountered in the initial search on hydrogen production and inquired how the same problems would have been handled in manual searching.

Mr Scott replied that basically the same approach would have been used, but it would have been more complex.

STORAGE AND RETRIEVAL OF CHEMICAL STRUCTURE DATA

P. J. GALLAGHER
'Shell' Research Ltd, Woodstock Agricultural Research Centre, Sittingbourne

Presented at a meeting of the Aslib Chemical Group, Wednesday 29th November 1967

Introduction

WOODSTOCK Agricultural Research Centre, operated by 'Shell' Research Ltd, is one of a number of Shell Company laboratories working in the agricultural chemicals field. One of the main functions of Woodstock is the synthesis of new chemical compounds for testing as potential new pesticides and over twenty thousand compounds have already been screened there since the laboratory was set up. A similar number of compounds have been examined at other Shell laboratories so that both chemical and biological data on nearly fifty thousand compounds are now available and are being augmented at a rate of around four thousand each year.

Until 1960–1 there was no formal system for the exchange of information between laboratories on new compounds being added to the system, and the chance of work being duplicated was increasing. It was also becoming apparent that manual methods would not allow the fullest possible use of the data collected and that machine-handling of this information would be required. In order to ensure that each laboratory had full details of all compounds synthesized and tested with a minimum of delay, a system for exchange of information on standard 5 by 8 inch data cards was set up to cover both biological and chemical data. At the same time it was decided to proceed to the next stage, the setting up of a computer system to handle chemical structures.

At Woodstock we felt that in the long run it would pay us to opt at the start for a complete description of the structure rather than use a fragmentation code, and for a number of reasons we decided to use the linear notation based on the Dyson system, which had recently been adopted by the International Union of Pure and Applied Chemistry as its official notation system.[1] The more important reasons for this choice were:

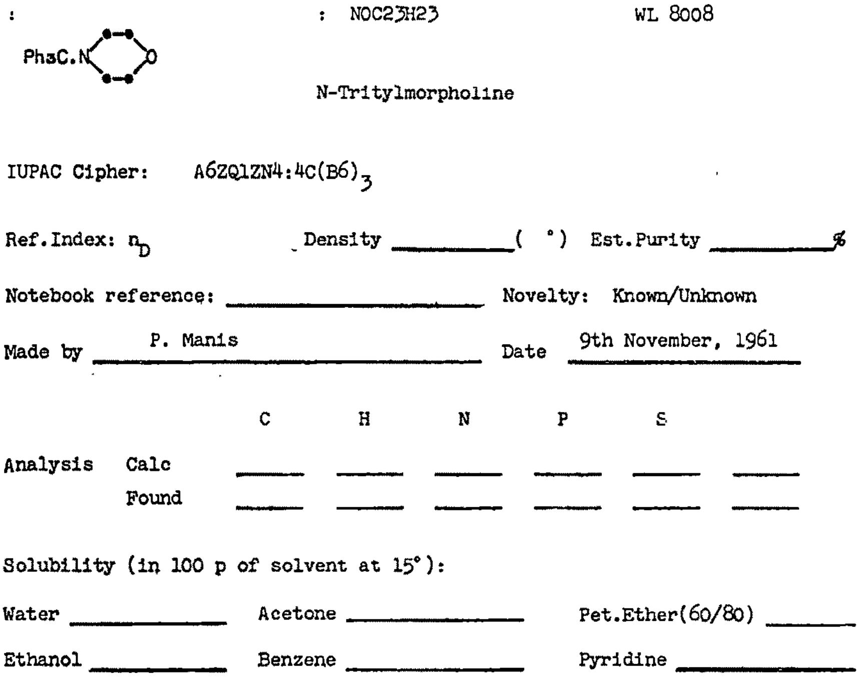
1 it had been approved by an official international body
2 at that time it appeared that the Chemical Abstracts Service of the American Chemical Society would use it extensively
3 Dyson was readily available in this country to act as a consultant in cipher matters.

In the USA, however, Shell Development Co. decided to follow up the chemical typewriter approach and this led to the development of a relatively cheap and simple version by Mullen[3] of their Emeryville laboratory.

This then gives some of the background to the system in current use at Woodstock which I would now like to discuss in more detail.

Manual system

When a new compound is synthesized the chemist concerned prepares a data sheet giving structure, name, method of preparation, etc., and the next sequential registry number is assigned to the compound. This number is prefixed by the letters WL to indicate Woodstock Laboratory. Separate number series are used at the other laboratories with different prefix letters. The draft sheet is then sent to the Technical Information Division at Woodstock for checking and ciphering before a 5 by 8 inch card is prepared from this draft, each item of information being typed into a set position on the card as shown in Fig. 1. Currently we are using the chemical structure typewriter to prepare these cards so that in addition to the printed output we also get the same information in the form of punched paper tape. Both tapes and cards are sent to the other laboratories (and vice versa) so that each one has complete records of all compounds in the system.



: : NOC23H23 WL 8008

N-Tritylmorpholine

IUPAC Cipher: $A6ZQ1ZN4{:}4C(B6)_3$

Ref.Index: n_D Density ________(°) Est.Purity ________%

Notebook reference: ____________________ Novelty: Known/Unknown

Made by P. Manis Date 9th November, 1961

		C	H	N	P	S	
Analysis	Calc						
	Found						

Solubility (in 100 p of solvent at 15°):

Water ________ Acetone ________ Pet.Ether(60/80) ________

Ethanol ________ Benzene ________ Pyridine ________

FIG. 1

We maintain two manual files based on the 5 by 8 inch cards. The first is a numerical one based on the compound registry number and forms the master file containing not only chemical data but also all results obtained from the biological tests. The file allows rapid access to all information relating to a specific compound once its registry number is known. The second is a molecular formula index in which cards are filed in alpha/numerical order using the molecular formula—written in the Fletcher notation—as the key.[4] This index enables a specific compound, the structure and hence the molecular formula

WL 8008

Cipher	$\mathrm{A6ZQ1ZN4{:}4C(B6)_{3}}$
Punch Card	A6ZQ1ZN4,4C(B6)=3

ROTENONE

Cipher	$\mathrm{B6_{4}5138\underline{15}ZQ57\underline{21}(2C_{3}E)\underline{20}EQ\underline{10}QC\underline{1213}h1H26\underline{1920}}$
Punch Card	B6=4*5138-1-5ZQ57-2-1(2C=3*E)-2-0EQ-1-0QC-1-2-1-3= H*1H26-1-9-2-0

D.D.T.

Cipher	$\mathrm{B6Ch;4/_{2}2C_{2}Chl_{3}}$
Punch Card	B6C=H*,4/=2*2C=2*C=H*1=3

2,4-D

Cipher	$\mathrm{B6Ch13{:}4Q/2C_{2}X}$
Punch Card	B6C=H*13,4Q/2C=2*X

FIG. 2

of which is known, to be rapidly located and its registry number determined. This index is frequently used by the chemists themselves to determine whether a compound they propose to synthesize is already in the system or not.

Invaluable as these two files are, they do not allow substructure searching unless the fragment happens to contain an unusual element or an unusually large number of more common elements so that the molecular formula index can be consulted. As we frequently receive requests for information on compounds structurally related to one which had shown some interesting activity, this was a definite drawback, and was one of the basic justifications for a computer-based system. Naturally, though, we hoped that once the computer system was operational we would be able to make far greater use of it. The computer system was not, however, intended to replace the manual indexes but to augment them and we do not envisage dispensing with them for some years to come.

Computer system

One of the first problems we encountered in using the IUPAC cipher as the basis for the computer system was the fact that it required a larger character set than was currently available on standard computers and also required the use of subscripts and superscripts. However, the use of monitor signals to indicate whether following characters were subscripts, superscripts or normal

Number of compounds		Number of characters in cipher		Contribution to average cipher length	
%	Cumulative	Range	Ave. length in group	Per group	Cumulative
2.5	2.5	11	6	0.15	
12.5	15	16	13	1.63	1.78
23	38	21	18	4.15	5.93
21	59	26	23	4.83	10.76
16	75	31	28	4.48	15.24
11	86	36	33	3.63	18.87
7	93	41	38	2.66	21.53
3	96	46	43	1.29	22.82
2	98	51	48	0.96	23.78
2	100	155	90	1.80	25.58

FIG. 3

line characters enabled this difficulty to be overcome. In cases where the characters are never used as subscripts or superscripts, as with letters of the alphabet, the monitor signals can be used to extend the character set. Thus an A punch preceded by the normal line monitor represents 'A', when preceded by the subscript monitor it represents 'a' and preceded by the superscript monitor it represents 'α'. Some examples of ciphers together with their punched card code equivalents are shown in Fig. 2.

Although at first sight this may appear rather complicated it presents few problems in practice. The keypuncher soon becomes familiar with the cipher and punches directly from it, inserting the monitor signals as and when required at roughly normal keypunching speed.

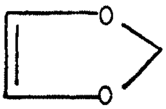
By the end of 1963 we had ciphered and punched some one thousand compounds, done trial searches and were convinced that the system was a practical proposition. By 1965 we had ciphered all the compounds then in the system, and had transferred the punched card data to magnetic tape. A file maintenance program was fully operational and searches were being carried out on a regular basis. Over this period it became obvious that the cipher was not only a practical method of converting structures to a linear form that could be manipulated on a computer, but was also an extremely efficient method of doing so. A detailed examination of the file recently confirmed this. As Fig. 3 shows, 59 per cent of the compounds required less than twenty-six punched card characters to code the cipher and less than 5 per cent required more than forty-five characters. Of the actual characters used, something like 25 per cent were in fact monitor signals.

Search strategy

When a request for a search is received, Technical Information Division staff who will write the necessary programs discuss with the chemist concerned the type of compound he hopes to retrieve and they can often advise him on whether his search is too broad, i.e. will retrieve an unmanageable number of compounds, or is too narrow and will retrieve only one or two compounds, if any. The program is then written, compiled and tested using in the first instance a card deck containing dummy compounds, some of which the program should retrieve if it is working correctly. When all programming and logical errors have been removed the program is run against the full file. The registry numbers of any compounds meeting the search requirements form the output to the program.

If, for example, we wish to search for compounds containing the methylenedioxy fragment shown on Fig. 4, a program such as the one shown in flow chart form on Fig. 5 would have to be written.

As it stands, this search would not ensure that the hetero-oxygens were in fact in the five-membered ring if there was more than one ring present. It is, however, easier and quicker to eliminate any compounds with the oxygens in the wrong ring manually than write what would be a fairly complicated program to do this on the machine. In actual practice such a search produced 156 compounds, of which only ten had to be rejected after visual examination of their structures.



Ring type	A or B
Ring size	5
Hetero atoms	0
Position	N and N+2
C in position	N+1

FIG. 4

The main drawback to the computer system at present is that the output from the machine is only a registry number. We are hoping to be able to add the name to this in the near future, but we cannot at present give the chemist what he really wants, i.e. the structural formula directly from the machine. If the number of compounds selected is not too great, e.g. less than fifty, we give him a photocopy of the 5 by 8 inch chemical data card either by copying the card from the numerical index on a Xerox or by making a copy from a microfilm of these same chemical data cards on a reader/printer held in the library. With larger numbers of hits we leave it to the chemist to peruse these files himself.

When the exact requirements of the search can only be met by a fairly complicated program, it is often more economical to set the search in slightly broader terms and do the final selection manually. This assumes, of course, that the search does not produce an unmanageable number of hits.

Programming

Programs to carry out the searches were originally written in IBM 1401 Autocode and a search of the full file, which in those days contained around thirty-five thousand compounds, took about twenty-five to thirty minutes. As most searches covered more than one query, this represents about £10/query in terms of computer costs (two queries/search). Although the language and the machine were ideally suited to the character-by-character examination required in the cipher search, a fairly high degree of programming skill was required. In order to make programming easier and also make the programs themselves less machine-dependent, we decided fairly early on to switch to Fortran. First efforts run on the IBM 1410 were not very successful, as searches were taking two hours or more to run. However, the IBM 7094 proved much more satisfactory and on this machine programs took five to seven minutes to compile and

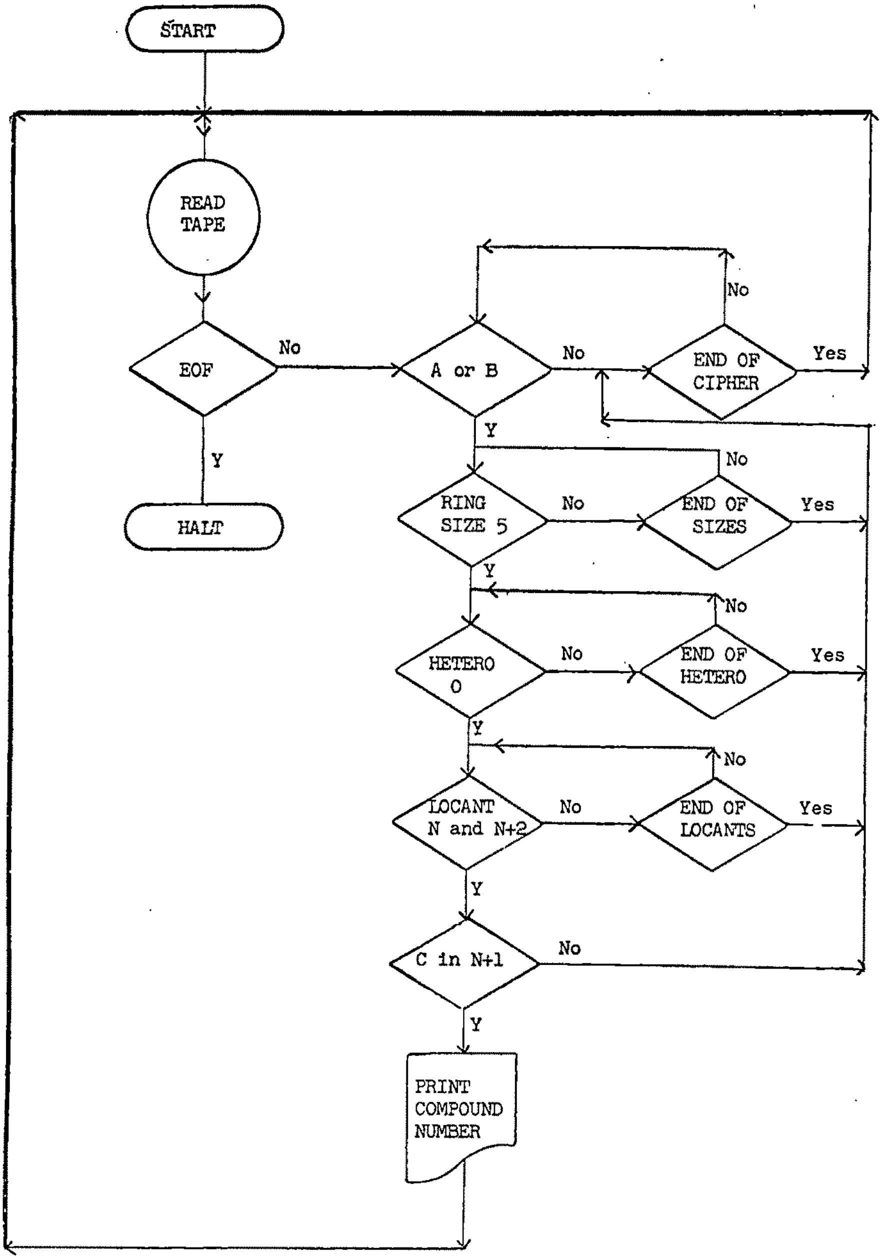

START
READ TAPE
EOF
No
Y
HALT
A or B
No
Y
END OF CIPHER
No
Yes
RING SIZE 5
No
Y
END OF SIZES
No
Yes
HETERO 0
No
Y
END OF HETERO
No
Yes
LOCANT N and N+2
No
Y
END OF LOCANTS
No
Yes
C in N+1
No
Y
PRINT COMPOUND NUMBER

FIG. 5

run, which cost about £15/query. Our main problem was then the long delay—sometimes as much as two weeks—between receipt of the request and provision of an answer, due to our having no computing facilities at Woodstock and having to send all our work to London. Even with a daily messenger service, programs sent one day were not returned until late the following day, so that 'debugging' could often be a long-drawn-out affair.

In May of this year Woodstock was linked to Shell's new central computer, a Univac 1108, by private telephone line. This meant that we had access to an extremely powerful computing system at frequent intervals each day, and although there have been the inevitable 'teething troubles' the link is now working reasonably well. With a new executive system allowing time-sharing and multiprogramming scheduled for early 1968, next year should see even greater improvements in the computing facilities available to us.

The main drawback at present is the slow tape-units currently used with the 1108. These make for lengthy search times of twelve to fifteen minutes and on a cost/performance basis this would make the 1108 an unattractive proposition. In order to make these search times more realistic, we shall be transferring the chemical structure file to a Fastrand drum as soon as the necessary file-maintenance programs have been written and tested.

When we first started carrying out searches it became obvious that writing a generalized search program would be an extremely difficult undertaking which would occupy all the available staff for several months. We therefore decided to write specific programs for each search as and when they were required. Over the two years that the system has been operational we have, however, developed a number of sub-routines covering input/output operations, detection of monitor signals, detection of frequently used features, etc. Current programs make extensive use of these sub-routines, but each new search still needs some specific programming effort.

Staff requirements

Excluding any one-off efforts required to deal with backlogs or the setting up of the system, the present operation at Woodstock dealing with cipher file maintenance and searching requires the part-time services of one keypuncher and one graduate. Maintenance of the file now involves ciphering and keypunching around one hundred compounds/week. These can be ciphered in about an hour and keypunched in about twenty minutes. The effort required for programming varies with the complexity of the search, and the actual time-lag between receipt of query and production of answer depends both on this factor and on the urgency of the problem. However, in cases of great urgency programs of average complexity can and have been written, debugged and run in five to six hours.

Naturally, speeds of this order are only reached after training and regular practice. We have found that about three months regular but not continual ciphering produces an efficient cipherer able to handle about sixty compounds per hour. A year or more experience is needed to reach the 100–150 compounds per hour our cipherer now achieves. Fortran programming normally requires a week's course (full time) and then fairly frequent practice for a month or two before searches can be written as a routine matter. It can be seen, therefore, that once a computer system has been set up it does not require a large highly trained staff to operate it. What we do believe, though, is that all the work should be done within the equivalent of our Technical Information Division, as it is essential for the programming to be done by someone very familiar with the subject field in general and the cipher in particular.

Future developments

When we decided in 1962 to go ahead with a computer system for handling our research data we envisaged it developing in a series of stages:

1 Setting up the system and entering the backlog of data. It was estimated that this could take two to three years.
2 Running of the full system, assessing its limitations and deciding on future requirements. Estimated at one to one and a half years.
3 Modifying and improving current system. Estimated at two years, overlapping to some extent with 2.
4 Long-range alterations to system. We do not envisage the system ever being static but plans are in hand covering, say, the next five years.

Stages 1 and 2 have been completed fairly well to schedule but plans for future developments had to be delayed until fuller details of the computing facilities to be available within Shell over the next few years became available in late 1966.

During our use of the system as described, the following limitations became apparent:

(*a*) It provides only the registry number as output to a search and requires a manual stage to give the output in a form the chemist prefers.
(*b*) There are certain queries which the cipher cannot answer easily or practically. For instance, a search for all compounds in which an oxygen and a sulphur atom are separated by two carbon atoms, any or all of the four atoms being possibly in a ring system, would not be a practical proposition using the cipher.
(*c*) There is no machine check that the correct cipher is being fed into the system.

As an interim measure to provide better output we are going to store as a pure tape image the punched paper tape which is obtained from the chemical structure typewriter. This image could then be punched out on paper tape if the compound met the current search requirements, and by feeding the paper tape back through the structure typewriter the structural formula can be mechanically reproduced. The only drawback to this feature will be the lack of coverage of older compounds—we do not envisage being able to type out the backlog of compounds for some time to come.

Overcoming the other problems depends basically on the development of a program to convert to an atom-connection table, i.e. a table indicating the spatial relationship between the atoms and the types of bond between them. Work at Chemical Abstracts[5] has already shown this to be a feasible proposition and we are currently working on the development of a Fortran program for our own use. From the atom-connection table it is a simple matter to calculate the molecular formula for the compound and this can be compared with the manually calculated formula which is currently fed into the system. This should provide a useful check on the correctness of the cipher. The table also forms a link with the description of the compound given by the structure typewriter. The punched paper tape is basically another form of connection table. Programs to convert this output to a standard form have been developed at Emeryville and we feel that there should be no unsurmountable problems in converting the cipher connection table to the structure typewriter connection table and vice versa. Once we can do this we shall have an extremely useful error-detection device. If these two separate forms of input match in their connection tables we can be almost certain that they have been entered correctly.

The connection tables should also form the basis for reproduction of structural formula on a line printer and/or cathode ray tube device. We hope in fact to install some form of CRT device at Woodstock in 1968, partly to do some experimental work on structure displays. Eventually one could envisage a number of these devices in the different laboratories, being used to display not only the output from substructure searches but also any data associated with a particular compound. When this type of system is operational we could dispense with our manual index.

Finally, the connection table enables any queries not suitable for simple cipher-searching to be handled without too much trouble.

Other developments in hand are the setting up of sub-files based on the presence of a particular feature in a cipher. This would mean that for a large number of searches we would need to examine only one or two of these sub-files rather than go through the full file of fifty thousand or more compounds. Availability of fast random access drum storage makes such an arrangement even more attractive and should reduce search times considerably. We already have in operation a Fortran program able to select the necessary features.

Also available is a file in which the ciphers have been sorted into alpha/numerical order. This file can be used to determine whether a specific compound is in the system. Although not an economic proposition at present when dealing with only one or two compounds, it becomes attractive when 50–100 or more have to be handled at one time, as can occur if batches of compounds are obtained from external sources.

Conclusions

Computerized handling of chemical structures has proved to be a practical proposition for a file of fifty thousand compounds and has not proved as expensive to run and operate as is often believed, though the time and effort in getting the system under way, particularly when a large backlog has to be dealt with, is considerable. With the rapid progress being made in the computer field at present, both in equipment and in reduction of operating costs, the use of computers in information storage and retrieval is becoming continually more attractive.

REFERENCES

1 IUPAC. Commission on codification, ciphering and punched card techniques. *Rules for IUPAC notation for organic compounds.* Longmans Green & Co., London, 1961.

2 FELDMAN, A., HOLLAND, D. B., *and* JACOBUS, D. P. *The automatic encoding of chemical structures.* Paper presented at the 141st National Meeting of the American Chemical Society, Washington, D.C., March 1962.

3 MULLEN, J. M. *Atom-by-atom typewriter input for computerized storage and retrieval of chemical structures.* Paper presented at the 150th National Meeting of the American Chemical Society, Atlantic City, New Jersey, September 1965.

4 FLETCHER, J. H., *and* DUBBS, D. S. Quick access to research records. *Chem. Eng. News,* 34 (1956), p. 5888–91.

5 DYSON, G. M., *et al.* Mechanical structures: molform computation and substructure searching of organic structures by the use of cipher-directed, extended and random matrices. *Information Storage and Retrieval,* 1 (1963), p. 69–100.

DISCUSSION

Dr A. Kent asked what type of search program was envisaged for the future.

Mr Gallaher replied that he anticipated continuing to carry out searches using the cipher for some time to come. However, the scope of the searches would be improved by having programs to convert the cipher to an atom-connection table. These tables should also make it possible to improve the output from the searches.

Mr Smith (Geigy) asked for comments on the Fortran language.

Mr Gallaher replied that Fortran was easier to learn than, say, IBM 1401 Autocode or Cobol, and was particularly well suited to applications where there was relatively little input and output and a large amount of arithmetic, e.g. many scientific and engineering applications. It was also machine independent to a large degree. However, it was not well suited to applications where large files had to be processed and where there was a lot of character manipulation. It was chosen here as the main programming language because it met the majority of users' needs, and it was decided to use it for cipher work, for which it was less suited, because of this.

Mr Rigby (Burroughs Wellcome) asked how many queries were received.

Mr Gallaher replied that on average about one or two a week were received at present.

Mr Ridgewell (Beecham Products) asked what the prospects were of having biological data on tape.

Mr Gallaher replied that most of the biological data from the standard screening tests was already on punched cards and was being transferred to magnetic tape.

Dr Batten (ICI) said that it was stated that generalized search programs were difficult to handle. In what way was the Woodstock method different from descriptor searching?

Mr Gallaher replied that, without going into the question in depth, in practice writing a generalized search was found to be much more difficult than it appeared on the surface.

Dr Batten (ICI) said that Chemical Abstracts had decided that for complete representation of chemical structures something more than a linear notation was required. What were the prospects for systems such as the Shell one to be converted to a CA notation?

Mr Gallaher replied that basically there was nothing to prevent this being done. The cipher contained all the information required to produce an atom connection table, which was what CA was using. Dr Dyson and his colleagues when at CA did in fact show this to be possible.

Dr Dyson said that the Japanese had recently described algorithms which would convert the cipher to atom-connection tables and vice-versa.

Mr Davy (Allen & Hanbury) asked why connection tables should be used at all.

Mr Gallaher replied that the connection table gave a description of the molecule in a different form from that of the cipher and hence allowed some searches to be carried out more readily.

A CASE STUDY OF THE *UNITERM INDEX TO US CHEMICAL PATENTS* USING A WEIGHTED TERM SEARCH TECHNIQUE

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Introduction

THE phenomenon of a rapidly increasing volume of technical literature is well known. The cost and time involved in the intellectual indexing and classification of much of this literature is uneconomic. A lowering of indexing standards and free text searching is being forced upon us. Computer applications and techniques are being devised to turn cheap and crude input into an acceptable level of output. This paper describes the application of such a technique and evaluates the search results. The search was conducted on the *Uniterm Index to US Chemical Patents,* issued by Information for Industry Incorporated, known as IFI.

Description of IFI Index

The *Uniterm Index to US Chemical Patents* is a co-ordinate index. It started in 1950 and up to the end of 1965 covered 150,000 patent specifications. The annual rate of growth is about fifteen thousand patent specifications. These patents include all specifications listed in the chemical section of the *Official Gazette,* enriched by specifications relating to any aspect of chemistry in the general, mechanical and electrical sections of the *Gazette.* At present, about 20 per cent of specifications processed are taken from outside the chemical section of the *Gazette.*

The index is constructed from the language or terminology contained in the patents themselves. The indexers underline words in the complete text of the specification, that is, the disclosure and the claims. Extra terms may be added if further description is thought necessary. IFI has a system of major and minor terms. Major terms are included in a ten thousand term word list. Minor terms are those having a posting of less than ten per year. About 283,000 minor terms have occurred. Nearly half of these are specific chemical compounds. Each specification is indexed to a depth of 40–45 uniterms. Computer input is entered by optical scanning equipment. The computer classifies the terms into major and minor. The minor terms appear in the manual editions of the index and are not included on the magnetic tape. A cumulative minor term index has been compiled for the years 1950–63.

Each specification is 'indexed' to a depth of about twenty-nine major terms, making a total of four and a half million entries on file. This is the largest commercially available co-ordinate index on magnetic tape. The size of the index and the freedom in choice of indexing terminology present a search problem. F. W. Matthews and Miss L. Thomson[1] in Canada have developed a search technique for dealing with this problem.

Outline of weighted term search technique

The preparation of a search by the weighted term technique includes the following steps:

1 Decide on the concepts to be included in the search.
2 Select search terms from the IFI word list to express each of the concepts. These should include synonyms, near-synonyms and/or generic terms—perhaps modifying the concepts as the term list is studied.
3 Order the concepts according to their importance in the inquiry, marking each with an alphabetic link A, B, C, etc.
4 Within the concepts arrange the terms by importance—steps 3 and 4 affect only the order of presentation of the answers.
5 Assign weights to the search terms. The highest weight being allotted to the first (most important) term in concept A, through to the lowest weight allotted to the last (least important) term in concept B or C (according to the number of concepts in the search question). The program accepts up to forty terms and twenty-six concepts.
6 Define limits, i.e. the minimum number of concepts acceptable and the minimum term or combination of terms acceptable in the answers. For example, answers must have at least one of the A terms and two concepts, i.e. a combination of A with any term from B, C, D, etc.

Computer operations

1 Search file, extracting all patents indexed under each term.
2 Co-ordinate the resulting lists, taking into account the minimum number of concepts specified. This will include all possible and/or logical combinations.
3 Compute a score by summing the weights assigned to the terms found in any given answer using the preferred term only in each concept. Eliminate answers with score below minimum. Answers with high 'score' indicate the co-occurrence of preferred terms and should have a high probability of being relevant to the inquiry.
4 Answer sets covering the combinations of search terms are printed in descending sequence of 'score' listing in a scan column index, the terms being found in each patent specification.

Search question

It was thought that the search question should help to fulfil two objectives, firstly, to evaluate the potential use to Pharmaceuticals Division of the computer tapes produced by IFI, and secondly, to demonstrate the flexibility and applications of the weighted term search technique.

Pharmaceuticals Division has for many years compiled indexes to the pharmaceuticals patent literature. It was desirable to select a search topic well covered by these indexes in order to check the recall from IFI tapes. In addition, it was thought that it should be a topic surrounded by fairly heavy patenting in order to assess the weighted search technique.

The search question chosen was for the patenting on the antibiotics, oxytetracycline and tetracycline, and, in particular, to their preparation by fermentation.

A list of appropriate search terms was compiled. The selection of search terms is determined by the interpretation of the inquiry and also by a knowledge of the IFI word vocabulary. Canadian Industries Limited has prepared two useful tools to aid this procedure. One is a computer program which prints a frequency table of terms giving the total posting for each term as well as the frequency by year. The other is a KWIC index of the terms. Fig. 1 shows a portion of the KWIC index, in particular, words containing the letters BACTER

```
           *BACKING, BACK                                   006850
                     *BACK FILLING                          006825
                     *BACK FLOW                             006830
                     *BACK TWIST                            006858
                     *BACK WASHING                          006800
                     *BACK- EXTRACTION                      006820
                     *BACK-UP                               006860
                     *BACKGROUND                            006840
                     *BACKING, BACK                         006850
                     *BACKLASH                              006853
                     *BACKSIZE                              006855
                     *BACKWARD                              006670
                     *BACON                                 006890
              *ANYLO BACTER AND-SPECIES                     003960
               *AERO BACTER, AEROGENES                      001150
                     *BACTERI CIDE                          006920
          *ACID-FAST BACTERIA                               000500
 *ACETOBACTER, ACETO BACTERIA                               000290
              *NITRO BACTERIA                               045740
      *GRAM NEGATIVE BACTERIA                               031160
      *GRAM POSITIVE BACTERIA                               031170
                     *BACTERIA, BACTERIOLOGY                006900
*ANTI MICROBIAL SEE-ANTI BACTERIAL
                     *BACTERIAL CANKER                      006910
                     *BACTERIAL ENTERITIS                   006914
               *ANTI BACTERIAL, ANTI MICROBIAL              004610
                     *BACTERIO PHAGE                        006930
          *BACTERIA, BACTERIOLOGY                           006900
                     *BACTERIOSTASIS, BACTERIOSTATIC        006940
    *BACTERIOSTASIS, BACTERIOSTATIC                         006940
             *ARTHRO BACTERIUM                              006080
             *CORYNE BACTERIUM AND-SPECIES                  017250
              *BREVI BACTERIUM AND-SPECIES                  009830
          *PROPIONI BACTERIUM AND-SPECIES                   056950
                     *BACTERIUM CYCLOOXIDANS                006950
                     *BADDELEYITE                           006955
                     *BADGE                                 006960
                     *BAEYER-VILLIGER REACTION              006970
                     *BAFFLE                                006980
               *HAND BAG                                    032020
        *STOCKINETTE BAG                                    066500
```

FIG. 1. PART OF THE KWIC INDEX

For the purposes of the KWIC, some of the words were fragmented into significant parts and separated by spaces, for example, the suffix CIDE as in bactericide brings together twenty terms in the list with related meaning.

Fig. 2 shows the terms selected, their arrangement into concepts and their importance in descending order as indicated by the term weights. Concept A contains the two antibiotics in question. Concept B contains terms associated with the preparation of these antibiotics by fermentation, including recovery from the fermentation broth and purification, which is the preferred aspect of the search question. Concept C contains terms broadly related to the uses of oxytetracycline and tetracycline. It is worth noting that concept C contains the synonyms antibacterials and bactericide, and the very near synonym bacteriostatics.

```
                       Search Question

                 Patenting on the antibiotics,
               oxytetracycline and tetracycline
                   and, in particular, their
                 preparation by fermentation.

TERM CODES
 49640 OXYTETRACYCLINE                            A 16
 69400 TETRACYCLINE                               A 15   A
 56415 PREPARATION                                B 14
 27580 FERMENTATION                               B 13
 58800 RECOVERY                                   B 12   B
 57590 PURIFICATION                               B 11
 10260 BROTH                                      B 10
 18130 CULTURE                                    B 09
 04620 ANTIBIOTICS                                C 08
 04610 ANTIBACTERIALS                             C 07
 06920 BACTERICIDE                                C 06
 31160 GRM NEG BACTERIA                           C 05   C
 31170 GRM POS BACTERIA                           C 04
 06940 BACTERIOSTATICS                            C 03
 43310 MICROORGANISMS                             C 02
 06900 BACTERIA                                   C 01
```

FIG. 2. GROUPING AND RANKING OF TERMS

Fig. 3 shows the first page of the print-out. This gives the IFI accession numbers and year of issue of the specifications, together with the conversion to US patent specification numbers and the term weights associated with each specification in the form of a scan column index.

The computer program selects the highest weighted preferred term that is present in each concept. These terms form the highest score and form set 1. The first specification listed in set 1 is US 2,734,018, which has the weights 8, 9, 11, 12, 13, 15 and 16. These weights have been assigned to the terms antibiotics, culture, purification, recovery, fermentation, tetracycline and oxytetracycline respectively. Oxytetracycline (16) is the preferred term in concept A. Preparation (14) is the preferred term in concept B, but this term is not present in any patent in the file that was indexed under the term oxytetracycline. The next preferred term in concept B is fermentation (13) and the preferred term in concept C is antibiotics (8). These term weights 16, 13 and 8 form the score and are present in all the specifications listed in set 1. The weights of the other search terms present are not used to derive the set score but their presence orders the listing of the specifications within the set.

Next, take set 2, which contains one specification, US 3,015,607, with term weights 13, 15 and 16. This specification has no concept C term. The next set, set 3, contains the preferred terms in concepts A and C but, in concept B, the preferred term, fermentation (13), has not occurred but the next preferred term, recovery with weight (12), is present. And so the procedure continues through twenty-two sets, covering about 5½ sheets of printout and listing 285 specifications.

The ticked entries in Fig. 3 indicate specifications relevant to the main aspect of the search question, that is, specifications relating to the preparation of

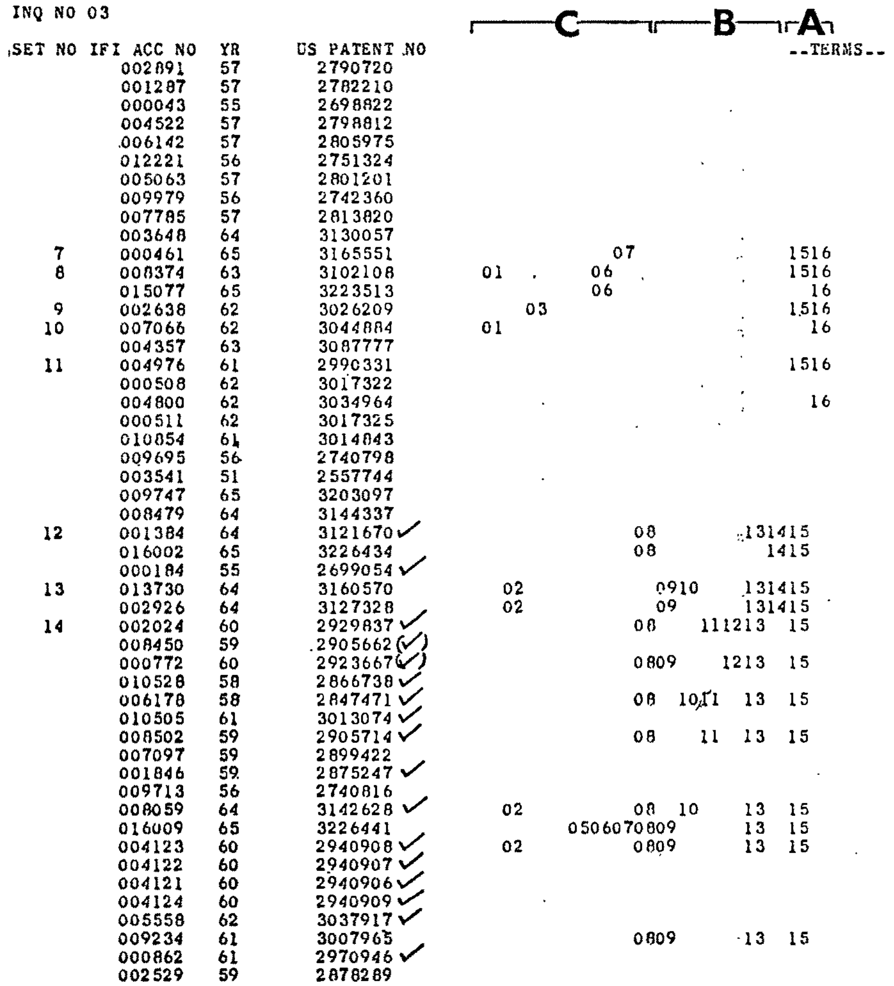
```
INQ NO 03                                  ┌───────C──────┐┌─────B────┐┌─A┐
SET NO IFI ACC NO  YR     US PATENT NO                                 --TERMS--
    1     008140   56       2734018✓                      0809  111213  1516
          004280   59       2886595✓
          002726   58       2831878✓                      08  10  1213  1516
          009877   61       3010876                     0708        13  1516
          012777   64       3157512            02          08        13  1516
          007393   63       3098744          01            08        13  1516
          001305   62       3022347                        08        13  1516
          005236   58       2843526
          002585   55       2712517✓
          004392   57       2798026✓
          003580   50       2516080✓                    07080910111213    16
          009021   60       2963401                        080910111213    16
          003905   53       2649480✓                      0809    1213    16
          005342   53       2658078✓                      08      1213    16
          000183   59       2867661✓
          001366   59       2873276✓                      08  1011  13    16
          011225   63       3113077✓                  06  08  10    13    16
          006808   61       2998352✓                      0809      13    16
          000874   59       2871166✓                      08        13    16
          004521   57       2798811
    2     000111   62       3015607                                  13  1516
    3     007813   62       3047617                     0708      12      16
          007357   60       2955108              03    06  08      12      16
    4     003125   63       3082253            02          08    11      1516
          004621   61       2988569                        08    11      1516
          008784   56       2736735
    5     006773   57       2809112          0102          0809            16
          002373   54       2678903            02          0809            16
    6     002096   64       3124468          0102        0708            1516
          005208   62       3036120                     0708            1516
          003848   61       2984686
          001640   61       2974167                040506  08            1516
          008853   59       2907693            02      06  08            1516
          006430   59       2895993                    06  08            1516
          006997   65       3200149            02  0405    08            1516
          010498   58       2866708                  05    08            1516
          015884   56       2766124              03        08            1516
          011080   62       3061513            02          08            1516
          009777   64       3148113
          008309   62       3050401          01            08            1516
          001044   61       2971885                        08            1516
          008785   60       2962378
          000504   61       2969291
          002677   62       3026248
          002082   61       2976318
          006465   60       2951760
          000509   62       3017322
          001676   62       3022218
          009739   61       3009956 (✓)
          009323   62       3053892
```

FIG. 3. PART OF THE PRINT-OUT

(Ticked entries indicate specifications relevant to the main aspect of the search question)

oxytetracycline and tetracycline by fermentation. Nearly all the ticks occur in set 1, which is the set with the highest score. In fact, 13 out of 20, or 65 per cent, of the specifications in set 1 are relevant. The specification at the bottom of Fig. 3, marked by a tick in brackets, relates to the preparation of tetracyclines by transformation of epitetracyclines and, as this is another way of making the antibiotics of interest, it is worth noting in case the inquirer was not aware of this method. This illustrates that the weighted term search technique allows answers to be retrieved from the co-ordination of terms in which some of the search concepts have not been expressed; albeit that these answers may have a low score but may be searched for rapidly, using the scan column index.

Fig. 4 shows the third page of the printout. The lowest scoring set, set 11, with an oxytetracycline (16) term, has been reached. The second preferred term,

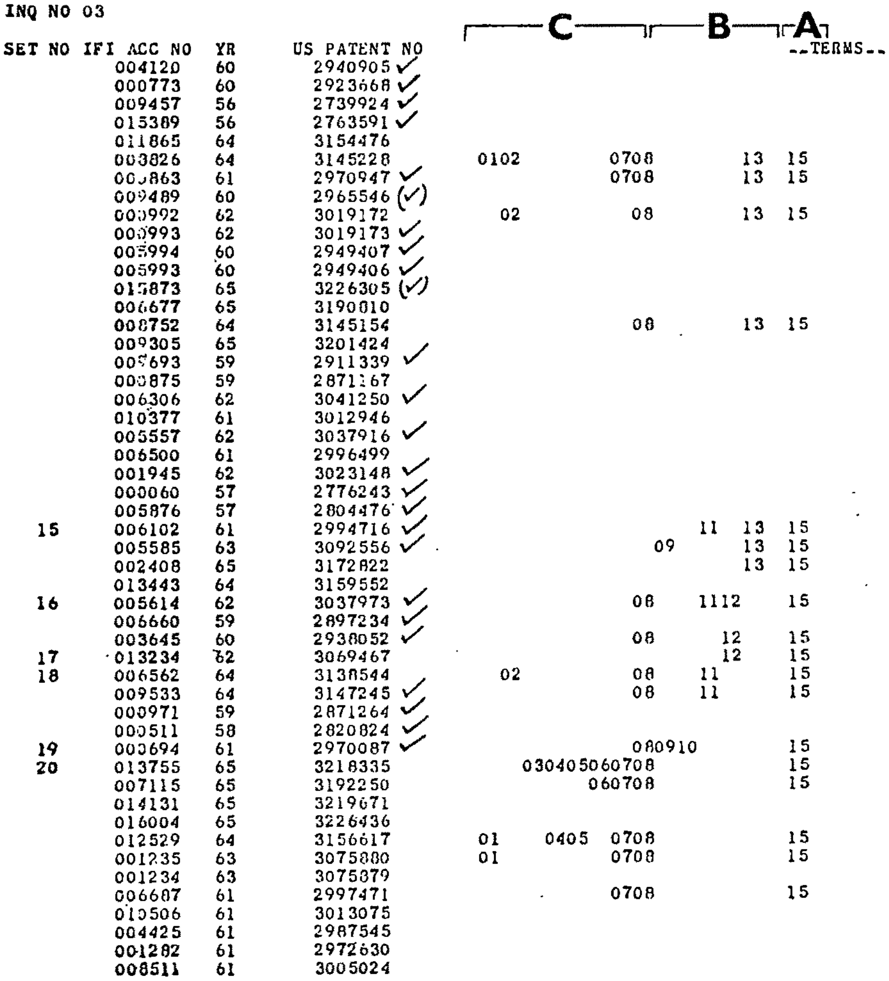


```
INQ NO 03                                 |------C------||-----B----||A|
SET NO IFI ACC NO  YR      US PATENT NO                                --TERMS--
          002891   57       2790720
          001287   57       2782210
          000043   55       2698822
          004522   57       2798812
          006142   57       2805975
          012221   56       2751324
          005063   57       2801201
          009979   56       2742360
          007785   57       2813820
          003648   64       3130057
    7     000461   65       3165551                    07              1516
    8     008374   63       3102108        01        06                1516
          015077   65       3223513                  06                  16
    9     002638   62       3026209            03                      1516
   10     007066   62       3044884        01                            16
          004357   63       3087777
   11     004976   61       2990331                                    1516
          000508   62       3017322
          004800   62       3034964                                       16
          000511   62       3017325
          010854   61       3014843
          009695   56       2740798
          003541   51       2557744
          009747   65       3203097
          008479   64       3144337
   12     001384   64       3121670 ✓                    08        131415
          016002   65       3226434                      08          1415
          000184   55       2699054 ✓
   13     013730   64       3160570          02            0910    131415
          002926   64       3127328          02            09      131415
   14     002024   60       2929837 ✓                    08    111213  15
          008450   59       2905662(✓)
          000772   60       2923667(✓)                   0809    1213  15
          010528   58       2866738 ✓
          006178   58       2847471 ✓                    08  1011  13  15
          010505   61       3013074 ✓
          008502   59       2905714 ✓                    08    11  13  15
          007097   59       2899422
          001846   59       2875247 ✓
          009713   56       2740816
          008059   64       3142628 ✓        02          08  10    13  15
          016009   65       3226441                  0506070809      13  15
          004123   60       2940908 ✓        02          0809        13  15
          004122   60       2940907 ✓
          004121   60       2940906 ✓
          004124   60       2940909 ✓
          005558   62       3037917 ✓
          009234   61       3007965                      0809        13  15
          000862   61       2970946 ✓
          002529   59       2878289
```

FIG. 4. THIRD PAGE OF THE PRINT-OUT

tetracycline (15), now dominates the print-out; there is a heavy posting of terms in the B concept and a high proportion of the specifications in sets 12 and 14 are relevant. Relevant specifications occur through to set 19 (see Fig. 5): 62 per cent of the specifications listed in sets 12 to 19 are relevant.

Experience from other searches has shown that over 80 per cent of the references listed in the highest scoring answer sets may be relevant. In this antibiotic search the figures are 65 per cent and 62 per cent. The reason is that the IFI terms oxytetracycline and tetracycline relate to the compounds *per se* and also to derivatives of the compounds. Most of the irrelevant specifications in the high-scoring sets relate to the preparation of derivatives of oxytetracycline and tetracycline. Even so, if the inquirer reads the specifications in the high-scoring answer sets he will have the majority of relevant specifications. In this



```
INQ NO 03

SET NO IFI ACC NO   YR       US PATENT NO                              --TERMS--
          004120   60       2940905 ✓
          000773   60       2923668 ✓
          009457   56       2739924 ✓
          015389   56       2763591 ✓
          011865   64       3154476
          003826   64       3145228        0102        0708        13  15
          003863   61       2970947 ✓                  0708        13  15
          009489   60       2965546 (✓)
          000992   62       3019172          02          08        13  15
          000993   62       3019173 ✓
          005994   60       2949407 ✓
          005993   60       2949406 ✓
          015873   65       3226305 (✓)
          006677   65       3190010
          008752   64       3145154                      08        13  15
          009305   65       3201424
          009693   59       2911339 ✓
          000875   59       2871167
          006306   62       3041250 ✓
          010377   61       3012946
          005557   62       3037916 ✓
          006500   61       2996499
          001945   62       3023148 ✓
          000060   57       2776243 ✓
          005876   57       2804476 ✓
   15     006102   61       2994716 ✓                          11  13  15
          005585   63       3092556 ✓                      09      13  15
          002408   65       3172822                                13  15
          013443   64       3159552
   16     005614   62       3037973 ✓                    08    1112    15
          006660   59       2897234 ✓
          003645   60       2938052 ✓                    08      12    15
   17     013234   62       3069467                              12    15
   18     006562   64       3138544          02          08    11      15
          009533   64       3147245 ✓                    08    11      15
          000971   59       2871264 ✓
          000511   58       2820824 ✓
   19     000694   61       2970087 ✓                    080910        15
   20     013755   65       3218335            030405060708            15
          007115   65       3192250                  060708            15
          014131   65       3219671
          016004   65       3226436
          012529   64       3156617        01    0405  0708            15
          001235   63       3075880        01          0708            15
          001234   63       3075879
          006687   61       2997471                    0708            15
          010506   61       3013075
          004425   61       2987545
          001282   61       2972630
          008511   61       3005024
```

FIG. 5. FOURTH PAGE OF THE PRINT-OUT

particular search all the strictly relevant answers fall within the high-scoring sets.

A further analysis of the total print-out of 285 specifications shows that fifty-one specifications (17.9 per cent) are relevant to the search question. Another eleven specifications (3.9 per cent) relate to other methods of making the desired antibiotics or, alternatively, to the preparation of fairly simple salts or complexes of oxytetracycline and/or tetracycline, and it is reasonable to consider these as possibly relevant. Eighty-six specifications (30.1 per cent) describe the preparation by any method of oxytetracycline and tetracycline derivatives; 123 specification. (43.2 per cent) relate to uses and/or compositions containing the tetracyclines in general. Thirteen specifications (4.6 per cent) are irrelevant in that the terms oxytetracycline or tetracycline are mentioned in the specifications, but these substances have no bearing on the disclosure. In most cases they occur in the preamble describing the known art. Finally, one specification (0.3 per cent) is totally irrelevant. It relates to oxytetrachlorides and, presumably, oxytetrachloride and oxytetracycline are adjacent terms in the IFI word list and the five-digit code for oxytetracycline was assigned in error.

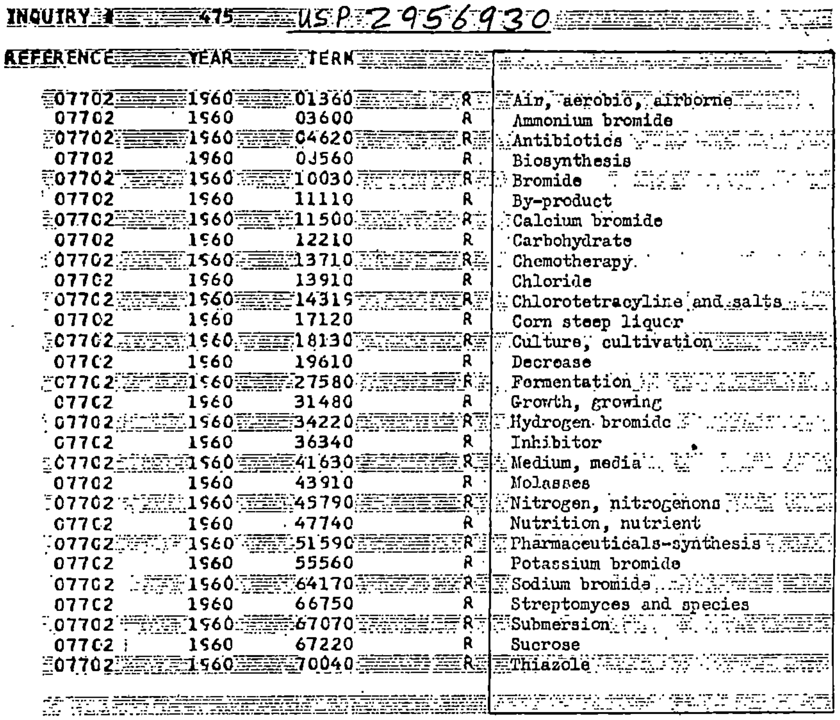
It is interesting to note that only 17.9 per cent of the total print-out is relevant, but that when the high-scoring answer sets were examined the relevance was 65 per cent and 62 per cent, and with the clustering effect of the weighted term search it was only necessary to look up about 30 per cent of the specifications in the print-out.

IFI recall

The total IFI recall of oxytetracycline and tetracycline patent specifications was assessed against Pharmaceutical Division patent indexes. There are nineteen known omissions. One of these specifications is highly relevant to the search question. Twelve specifications relate to the preparation of derivatives of oxytetracycline and tetracycline and six to uses or compositions of tetracyclines in general.

In order to determine why these specifications have not been recalled a reverse search was run. In a reverse search the system is asked to print-out all the terms used to index each of the patent specifications in question. Fig. 6 shows the terms assigned to US 2,956,930. This specification is relevant to the search. Most of these terms are valid within the IFI approach to indexing. The only term of consequence which is omitted is the vital term, tetracycline. In fact, the first paragraph of US 2,956,930 begins: 'This invention relates to the production of tetracycline . . .'

The reverse search showed that five of the composition and use specifications were adequately indexed. The failure to index under oxytetracycline or tetracycline is excusable here, as these substances are only exemplified as suitable antibiotics to include in the compositions. However, one of the composition specifications was entitled 'Tetracycline Formulations' and should have been indexed accordingly. In most of the specifications relating to tetracycline derivatives the term antibiotics is present. There is a failure to describe the tetracyclic structure but some of the substituents, such as hydroxy, nitro and cycloalkyl, were listed as terms, although their value in this context is question-



INQUIRY # 475 USP 2956930

REFERENCE	YEAR	TERM		
07702	1960	01360	R	Air, aerobic, airborne
07702	1960	03600	R	Ammonium bromide
07702	1960	04620	R	Antibiotics
07702	1960	03560	R	Biosynthesis
07702	1960	10030	R	Bromide
07702	1960	11110	R	By-product
07702	1960	11500	R	Calcium bromide
07702	1960	12210	R	Carbohydrate
07702	1960	13710	R	Chemotherapy
07702	1960	13910	R	Chloride
07702	1960	14319	R	Chlorotetracyline and salts
07702	1960	17120	R	Corn steep liquor
07702	1960	18130	R	Culture, cultivation
07702	1960	19610	R	Decrease
07702	1960	27580	R	Fermentation
07702	1960	31480	R	Growth, growing
07702	1960	34220	R	Hydrogen bromide
07702	1960	36340	R	Inhibitor
07702	1960	41630	R	Medium, media
07702	1960	43910	R	Molasses
07702	1960	45790	R	Nitrogen, nitrogenous
07702	1960	47740	R	Nutrition, nutrient
07702	1960	51590	R	Pharmaceuticals-synthesis
07702	1960	55560	R	Potassium bromide
07702	1960	64170	R	Sodium bromide
07702	1960	66750	R	Streptomyces and species
07702	1960	67070	R	Submersion
07702	1960	67220	R	Sucrose
07702	1960	70040	R	Thiazole

FIG. 6. TERMS ASSIGNED TO US P 2,956,930

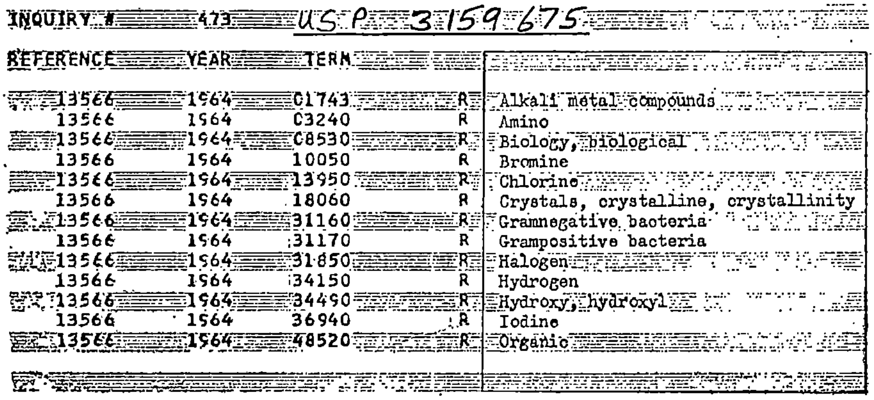
able. Two specifications are so badly indexed that it is doubtful whether they could ever be retrieved. Fig. 7 shows the indexing associated with US 3,159,675 and illustrates the point without further comment. This specification relates to new 4-dedimethylamino-4-oxo-6-demethyltetracycline-4-oximes and 4-hydrazones.

A reverse search of this kind could suggest new search terms and possible modifications in the search profile, but in this particular case no clear pattern emerges, which indicates that the search requires amendment. The omissions are, in general, attributable to IFI input failure.

The reverse procedure, that is, measuring the recall from Pharmaceuticals Division Indexes against IFI, is not so straightforward because the Division does not select on such a broad basis as IFI, e.g., specifications relating to embalming compositions, hide and food treatment, are not usually selected. However, the IFI search revealed three composition specifications not recorded, although the corresponding United Kingdom specifications were known.

Chemical Abstracts search

Finally, a search was made in *Chemical Abstracts*. The subject indexes were consulted and either directly, or by using cross-references or the patent concordance, forty-nine of the fifty-two relevant specifications were found. The other three specifications are all highly pertinent but are not indexed in *Chemical*



```
INQUIRY #        473        US P 3 159 675

REFERENCE        YEAR        TERM

   13566         1964        01743              R   Alkali metal compounds
   13566         1964        C3240              R   Amino
   13566         1964        C8530              R   Biology, biological
   13566         1964        10050              R   Bromine
   13566         1964        13950              R   Chlorine
   13566         1964        18060              R   Crystals, crystalline, crystallinity
   13566         1964        31160              R   Gramnegative bacteria
   13566         1964        31170              R   Grampositive bacteria
   13566         1964        31850              R   Halogen
   13566         1964        34150              R   Hydrogen
   13566         1964        34490              R   Hydroxy, hydroxyl
   13566         1964        36940              R   Iodine
   13566         1964        48520              R   Organic
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FIG. 7. TERMS ASSIGNED TO US P 3,159,675

Abstracts under oxytetracycline or tetracycline or their corresponding chemical names. It is unlikely that any conventional search of *Chemical Abstracts* for specifications relating to the preparation of oxytetracycline or tetracycline would capture these three specifications. They all occur in the numerical patent index. In fact, all but four specifications in the IFI printout were found in *Chemical Abstracts* by consulting the numerical patent indexes and patent concordances. Although to retrieve these specifications by searching the subject indexes would be a long and tedious job because many of the specifications are not indexed under a tetracycline term and heavily posted terms, such as antibiotics, would have to be searched. In other words, the depth of subject indexing in IFI is greater than that for *Chemical Abstracts.*

Conclusions

The IFI tape is a useful reference source. In Pharmaceuticals Division its main application will be to assist in answering inquiries on topics outside or on the fringe of the Division's patent literature coverage. If the inquirer is a research man requiring technical background information in a particular field, then the weighted term search technique displays for him the information he needs, with little effort or time required on his part. Similarly, he can frame a question on a new idea and determine how much work has been done in the field and where the gaps exist. If the inquirer is a patents man, then of course it may well be that he will want to check every reference, that is, those in high and low scoring sets.

The weighted term search technique has applications in other fields where a large inverted file exists. Some thought is being given to its use in ordering computer generated chemical fragments in substructure searches.

REFERENCE

1 MATTHEWS, F. W., *and* THOMSON, L. Weighted term search: a computer program for an inverted co-ordinate index on magnetic tape. *J. Chem. Doc.*, 1, 1967, p. 49–56.

DISCUSSION

Mr Smith (Geigy) asked how the values of the weights were allocated.

Miss Haygarth Jackson replied that the value of the weights were allocated by giving the most important term in the most important concept the highest weight, through to the term considered least important, in the least important concept, the lowest weight. Within this ruling the value of the highest weight is an arbitrary value. It could be 50 and the next highest weight 45.

Dr M. H. Dilke (BP Chemicals) asked what happened to the minor terms which were excluded from the magnetic tape.

Miss Haygarth Jackson replied that those concerned were in the annual printed dual dictionaries which could be searched manually. Minor terms from 1950 to 1963 had been cumulated. Du Pont had compiled a molecular formula index of the specific compounds which had occurred as minor terms.

Dr Kent (Nottingham University) asked whether it would be useful if there were provision for giving terms of equal importance the same weight, e.g. in this case oxytetracycline and tetracycline.

Miss Haygarth Jackson replied that in practice, with the scan column listing, this was not a problem.

The Chairman commented that even though different figures were given for major terms, in one's own mind they were equally relevant.

Mrs King Jones (Bayer) asked where there was any bias towards pharmaceutical patenting in IFI.

Miss Haygarth Jackson replied that IFI covered all US chemical patenting. About 10–15 per cent of this patenting was related to pharmaceutical inventions.

Mr Wrigley (Wellcome Foundation) asked Miss Haygarth Jackson how she would retrieve the *first* patent on tetracycline, the significance of which would not be evident in the terms assigned to it. Secondly, had she advised her Patents Department on how to write patents that could not be retrieved?

Miss Haygarth Jackson replied that the first patent in a new field might not be retrieved by this method because the name of the substance would not be a major term, but it could be captured by a broader term search. The answer to the second question was 'no'.

Mr Shillingford (ICI) asked how long the manual search of *Chemical Abstracts* took.

Miss Haygarth Jackson said that this work was carried out by a vacation student over a period of two weeks. The student was a chemistry graduate waiting to start a post-graduate course in information science.

Dr Dilke (BP Chemicals) questioned the value of this service for US patents in this country, in view of the availability of earlier patent publication.

Miss Haygarth Jackson replied that the use was limited, but justified in the field of pharmaceuticals, because about 50 per cent of the US patenting in this subject was limited to the United States, that is, corresponding specifications were not filed in other territories. IFI was not a current awareness service, but a retrieval service.

Mr Reynolds (Vinyl Products) said that the paper described the use made of three services, one internal and two external, of which two sources together provide all the answers. Was this a general case? Was it advisable to use two commercial services or one internal and one commercial?

Miss Haygarth Jackson replied that it was probably true to say in general that no single source was adequate. The problem eventually came down to one of cost. This should be supplemented by the best commercial service available. Much depended on the size and nature of the organization and the emphasis that was placed on patenting.

Miss E. Heilpern (BP Trading Ltd.) asked whether in comparing *Chemical Abstracts* and other sources a US Patent Office *File List* was taken into account.

Miss Haygarth Jackson replied that it was not.

CURRENT AWARENESS SEARCHES ON *CT*, *CBAC* AND *ASCA*

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Presented at a meeting of the Aslib Chemical Group, Wednesday 29th November 1967

Introduction

DURING the past year we have been one of the organizations participating in the Chemical Society's experiment on the use of routine computer searches of *Chemical Titles* (*CT*) and *Chemical-Biological Activities* (*CBAC*) for current awareness. For some time we have also been subscribing to the *Automatic Subject Citation Alert* (*ASCA*), which is produced by the Institute for Scientific Information as a by-product of the *Science Citation Index*. These three sources differ in their scope and methods, but share the same ultimate objective of providing a computer-based current awareness service.

CT covers journals in all branches of chemistry, but provides only authors and titles, the latter translated into American and edited by breaking down complex words so that word fragments can be retrieved. *CBAC* covers only papers on the interaction of chemical compounds with biological systems, but provides abstracts which are available for computer search. The computer can also search for molecular formulae and for *Chemical Abstracts* registry numbers of all compounds included in the abstracts. *ASCA* in its original form was based on citations: the search profile can consist of a list of references to older work, and the output is then a list of new papers citing this work. Last spring *ASCA* introduced a 'term search', which is a search for words in the titles of current papers and is therefore analogous to a *CT* search.

This paper discusses and compares the results we have obtained so far with these three services, and the potential use of systems of this type.

CT and *CBAC* searches

These searches were carried out at the University of Nottingham using computer tapes supplied by the Chemical Abstracts Service, but with programs specially written for the British computer. Our search profiles were submitted by eighteen individual scientists—thirteen chemists, three biochemists and two pharmacologists—most of whom are responsible for several profiles. We have a total of thirty-five different profiles, of which fifteen are run against

CT only, eleven against *CBAC* only, and nine against both services. Some of these profiles represent quite narrow personal interests of individuals, while others cover broad fields which are useful to whole departments. The information department as such did not submit any profiles, but we saw that our main fields of interest were adequately covered among the various individual profiles.

A search profile for *CT* and *CBAC* consists of a series of parameters, each of which may contain any number of alternatives, linked by AND or NOT. It thus expresses the logic:

(A or B or . . .) and (M or N or . . .) . . . but not (X or Y or . . .).

About a quarter of our profiles have only one parameter (occasionally only one term), and a few have three or four parameters, but most have two. We have used NOT logic in order to cut some of the irrelevant material from wide searches—for instance, a search for 'imidazole' has a series of NOT terms such as 'dye' and 'polymer' in an attempt to avoid these fields of chemistry. These terms are best added after the broader search has been running for some months: only then can you see which words occur sufficiently often in irrelevant papers but never in relevant ones. In a *CBAC* search it may be a help to use the registry numbers of specific well-known compounds as NOT terms; the risk then is that they may be mentioned in comparisons with more interesting compounds, and references to the latter will thus be lost.

The British search programs allow for the use of weights in order to express the logic:

A or (B + C)

or A or [B + {C or (D + E)}]

The profile for the last example might be written:

Parameter 1	A	weight 100
	B	50
2	C	50
	D	25
3	E	25
	Threshold weight	100

Here the weighting conditions override the normal search structure, so that the search is satisfied equally by A alone, or by (B + C), or by (B + D + E), but not by B alone or by (B + D). Only the highest weight found in each parameter scores, so that if only C, D and E were present the total would be seventy-five and that item would be rejected. NOT logic cannot be used with weights; instead negative weights are used. An example of this is the search shown in Fig. 1, which is a simplified version of one of our profiles intended to retrieve papers on electrochemical synthetic methods. Terms like 'electrochemistry' and 'electrochemical' are acceptable only if they are not associated with 'plating'; 'electrolytic coupling' is wanted but 'electrolytic precipitation' is not; 'oxidation' at an 'electrode' is interesting provided that 'polarography' is not involved. 'Kolbe' is included with weight 100 as the best-known named reaction in this field. This profile had to be modified several times and still produces a considerable number of irrelevant references, but the output of relevant papers is satisfactory.

We now receive the output from our *CT* and *CBAC* searches in two forms: as a printed sheet of references for each profile, and as a series of cards, one for each reference found. In each case full bibliographical information is printed out, with journal titles in full as well as codens (a luxury which is much appreciated) and *CBAC* abstract numbers; the profile list also gives for each reference the search terms by which it was retrieved. This arrangement has proved very satisfactory. The individual user receives the cards, which he can file or discard as he pleases, and the information department keeps the listings for future reference.

Because of the difficulties in the early days of the experiment, the following discussion will be based on the results obtained on thirteen issues each of *CT* and *CBAC*, received during the six months April to September. Table 1 shows how the size of the output, in terms of references per issue, varies among the profiles. It will be seen that we are working with relatively low output, particularly for *CT*, where a third of the profiles average less than one reference per issue, and more than half average fewer than five references per issue.

Relevance is difficult to assess impartially, particularly for a current awareness search. The cards we receive as output for *CT* and *CBAC* have tear-off strips on which the user can mark 'relevant', 'not relevant' or 'relevance cannot be determined from the title', and these strips are sent back to Nottingham. Our instructions are that relevance is to be assessed strictly from the title, and in terms of whether the paper answers the *intention* of the profile, regardless of the keywords actually used for the search. It is difficult to draw conclusions from these individual assessments, because people obviously differ in their standards, and are generally inclined to err in the direction of 'being kind to the computer'.

Interpretation of the results is complicated by the high proportion of answers (ranging from 7 to 57 per cent for *CBAC* and from 0 to 35 per cent for *CT*) in the class 'relevance cannot be determined from the title'. There is certainly no obvious correlation between the proportions of 'relevant' or 'not relevant' answers reported and the size of the output or the complexity of the logic.

We find that our results on relevance divide profiles into three general classes. First there are a number of broad profiles with high output and high relevance scores, often approaching 100 per cent. These high scores are genuine, in so far as most of the answers are in the right field of interest and provide background information for a research project, even though few of them may be of immediate interest. These profiles are extremely useful to an information department: I have been struck, when looking through some of our earlier print-outs, by the number of references which were not important when we first received them but have become much more interesting in the course of a few months because of changes in the emphasis of our research within a broad general field. The file of printouts can therefore serve as a tool for short-term retrieval as well as for current awareness. Because any individual paper appears considerably later in *CBAC* than in *CT*, the *CBAC* search for a profile run on both tapes gives a second chance to notice titles which may have been ignored when they appeared in *CT*.

Next, we have a considerable number of profiles (mostly in *CT*) with very low output but very high relevance, which usually represent personal interests—a small class of compounds, or a particular reaction. An example is a search for 'orthoesters' in *CT*. These restricting profiles are very dangerous, the more so because the users are often very well pleased with them. They believe that little or no work has been published on their particular hobby, and they are glad to have their belief confirmed, but they forget that these specific subjects may not be reflected in the title of a paper. Thus although our 'orthoester' profile contains alternatives such as 'orthoformate' and 'orthoacetate', it can still retrieve only references where reactions of these compounds are the main point of the papers, and must miss many examples of interesting reactions which are incidental to some other theme. The high relevance of these searches is likely to be accompanied by very low retrieval efficiency.

The third group of profiles contains those with low relevance, though perhaps quite high output. Many of the irrelevant answers are produced by asking a broad question through inability to express a more specific one. One of the commonest cases of this problem arises when a search is to be limited to organic chemistry. For instance, we have a search for organic compounds of thallium, but we found it best to search simply for 'thallium' (or rather *THALL*) and eliminate the many inorganic and metallurgical papers from the print-out by inspection. A typical relevant title is 'Preparation of methylthallium (III) diacetate', a paper which appeared in *Inorganic & Nuclear Chemistry Letters;* excluding certain journals would therefore not solve the problem. The same sort of difficulty arose in a search for guanidine derivatives of the type synthesized as analogues of guanethidine. A medicinal chemist can recognize this class of compound quite easily but finds it very difficult to define the structure concisely, and the user of this profile decided to ask simply for papers on any guanidine derivatives with more than seven carbon atoms. Even this limitation cannot be expressed suitably, so we searched only for 'guanidine' and screened the output afterwards for relevant papers. Later, in the light of experience, we were able to modify the search by a NOT term excluding (by registry number, since this was in *CBAC*) half a dozen compounds, such as guanidine itself and aminoguanidine, which occur frequently and were not wanted.

We have no objection to these low relevances searches on *CT*, provided the output is not too large, because it is usually quite easy to cross off most of the irrelevant answers by inspection. The problem is rather more serious with *CBAC*, because if the keywords occur in the abstract but not in the title, it is difficult to be sure from the print-out that the paper does not contain *any* relevant information. A *CBAC* output therefore really needs to be read in conjunction with the printed version, which may arrive considerably later than the computer print-out.

Another cause of irrelevant references in *CBAC* is the association of two keywords which are not logically related in the abstract, since the whole of the abstract and title is searched as one unit. Terms such as 'stimulation', 'secretion', 'increase', 'metabolism', which are very common in *CBAC*, are particularly likely to produce false drops, and it is inevitable that the papers on the influence of a specific compound *on* metabolism (for instance, in bacteria) will be retrieved in a search for papers on the metabolism *of* that compound in animals. We also found that the term 'stomach' retrieved a considerable number of irrelevant papers on drugs administered by stomach tube: there is scope for the introduction of standard abbreviations or codes which the abstractors could use to describe such routine operations.

The relevance of a search is not nearly as important in practice as its retrieval efficiency—how many relevant papers have been missed? It is much too easy to forget, when a search is regularly producing a comfortable number of relevant references, that it may be missing an equally large number of even more important ones. Our experience, with Medlars and Ringdoc searches as well as with those discussed here, is that the more sources of information you use the more you find new information which has been missed by all the other sources. We have attempted to investigate this problem by asking our users to let us know of missed papers, by checking our own files, by looking up appropriate keywords in the Ringdoc indexes (Derwent Publications), and by comparing the output of corresponding searches in *CT* with *CBAC* or of either of these with *ASCA*.

In principle, papers may be missed either because they were not in the system, or because they were there but were not retrieved. The former implies inadequate journal coverage or article selection, the latter inadequate indexing. In the case of *CT*, the journal coverage should be adequate for any purely chemical search, but we have found a few instances where whole issues of chemical journals have been missed. There are also a number of cases where individual papers on fringe subjects have not been included in *CT* although they seem as 'chemical' as many which have been found. We have at least one example of a paper missed because of a misspelling of the keyword, and have noticed several more cases of misspelling or faulty punctuation in words which were not being used for our searches.

A more serious limitation of *CT* is the fundamental difficulty that a title is not an index. This is clearly revealed by a study of our *CBAC* printouts. Table 2 shows, for those *CBAC* profiles which are producing considerable numbers of relevant references, the proportion of relevant papers which had *any* appropriate keywords in the titles, regardless of their logical relation. We included here any keywords which might reasonably have been used in a 'titles' search, not only those we had actually used for *CBAC*. The superiority of the *CBAC* approach over that of *CT* is plain, particularly for searches with a substantial chemical content: biological papers are on the whole better served by their titles.

Some examples will illustrate the shortcomings of titles. Thus in the search for guanidine derivatives mentioned above, many of the relevant titles which did not contain the word 'guanidine' did mention 'adrenergic neuron blocking', 'sympatholytic' or 'antihypertensive' activity. However, a search using 'antihypertensive' as an alternative term would inevitably produce many papers which had nothing to do with guanidine. Again, in a *CBAC* search for the metabolism of thiophene derivatives, papers on cephalosporin derivatives figured prominently; these were named as thiophenes (or thienyl compounds) in the abstract but never in the title. A generic search of this type, if it is to be complete, must therefore name all the common compounds of the class. Some other examples are shown in Table 3, which lists some of the titles obtained from a *CBAC* search for 'imidazole' and by using the keyword 'imidazole' in the Ringdoc index. These illustrate two further difficulties: the paper with a title broader than the search term ('. . some diazoles . .'), and the title which names the starting materials of a reaction when the search term is the product.

Thus *CT* and *CBAC* represent opposite approaches to retrieval. *CT* suffers from the severe limitation of searching only on titles, but *CBAC*, searching on a whole abstract with uncontrolled language, suffers more severely from false drops. We may find the ideal system somewhere between these extremes—possibly by adding keywords to *CT*, or by searching on separate paragraphs of *CBAC*.

Comparison of *ASCA* with *CT/CBAC*

We have made a detailed study of three simple searches which we have been running for six months on *ASCA* and also on *CT* or *CBAC*. Because they are simple, they do not test the differences in the logic capabilities of the systems. (The only obvious difference here is the absence of weighting from the *ASCA* programs.)

There is an important difference in the nature of the material on the search tape. *ASCA* puts the title on the tape with its original punctuation and in its original language (except for titles in non-Roman alphabets, which are translated into English), whereas *CT* translates all titles (including English) into American, and breaks up complex words. Terms for a *CT* search can be truncated at the beginning or the end, whereas those for *ASCA* at the time of our experiment could be truncated only at the end. (Truncation at the beginning of the word is now being offered by *ASCA*.) Another important difference is in journal coverage, since *ASCA* covers the whole range of science, but takes fewer chemical journals than *CT*. There is a substantial difference in the treatment of Russian journals: *CT* works from the original Russian journals, whereas *ASCA* works from the cover-to-cover translations where possible, and takes very few original Russian journals. *CT* provides much better cover of the Russian and Japanese journals than *ASCA*. This may not be very important for an alerting service, since many people would prefer to wait for an English abstract before ordering an obscure paper in a difficult language, but it will be significant if people rely on these sources to the exclusion of the abstracting journals.

For the papers which were retrieved by both *ASCA* and *CT* we noted the differences between the times at which the two searches were run. On the average this difference was very small (*ASCA* being one week ahead for one search and one week behind for the other), but the variations were large, and individual papers could appear up to eight weeks earlier or later in one service than the other (see Fig. 2). This makes it difficult to make an exact comparison of the outputs over a period as short as six months.

The three searches were in different subject fields and show different characteristics. The first was the search for organic compounds of thallium already mentioned; papers were counted as relevant when they dealt with these compounds, or with the toxicology of thallium. The results are summarized in Table 4. It will be seen immediately that a large proportion of the relevant papers were found by one system only. About half of the misses can be ascribed to differences in journal coverage and to the different treatment of Russian journals already mentioned, but the other discrepancies are more difficult to understand. Papers found by *ASCA* but missed by *CT* include reviews of an important book on organothallium compounds (*ASCA* actually reported five different reviews, but we counted these as one reference), and an abstract of a paper read at a meeting. Rather surprisingly, there was no obvious sign that *ASCA* was retrieving physics papers that *CT* had missed: within the scope of its journal coverage, *CT* retrieved a number of papers well over the border towards physics. In an attempt to minimize the effect of time lag between the services, we compared the *ASCA* output with only the middle three months of the *CT* output. Two papers were missed by *ASCA* during this period because of the lack of initial truncation: the words in the titles were methylthallium and halothallates. In fact, if there had been a paper entitled 'organothallium compounds', the object of the search, the *ASCA* term search would have missed it. However, it is interesting to note that the paper on methylthallium was in fact found by *ASCA* through a citation.

The next search (Table 5) was for all papers on imidazole chemistry, with a marginal interest in pharmacology and biochemistry. This is an example of a subject where titles are very inadequate, and we have already listed a number of relevant papers which could not be retrieved by title. It is also an example where the search term, in ordinary text, may not occur at the beginning of the word, so that either initial truncation or splitting of words is necessary. The *CT* search retrieves all papers on benzimidazole as well as imidazole, but by the time we started the *ASCA* searches we had decided that benzimidazoles and naphthimidazoles were of marginal interest to us. The figures in the table are therefore based on *CT* searches from which benzimidazole and naphthimidazole references have been deleted. Of the references missed by *ASCA,* half were missed because 'imidazo' was not the beginning of a word (see Table 6), and the other half are nearly all accounted for by inadequate journal coverage. It is interesting to note that in this case it was the word splitting of *CT* which mattered, rather than the search technique, because *CT* invariably splits chemical names so as to bring the name of heterocycles to a key position. This would not have been true of a *CBAC* search.

We have also used seven citation references, relevant to various minor aspects of imidazole chemistry, in our *ASCA* profile, and during the test period these produced twelve references of which only five were found by the term search. The other seven could not have been retrieved by title, although four of them were highly relevant. This is our general experience of the citation method: although we have used it for restricted topics rather than for general fields of interest, the relevance and interest of the papers retrieved has been very high. A group of about twenty references in a different subject field, which have been in our *ASCA* profile for seventeen months, yielded a total of 104 references of which seventy-five were considered useful enough to be passed on to the research department.

The third search was one with small output and high relevance, which was run on *CBAC*, not *CT*. The search was for all papers on carbonic anhydrase, with fundamental enzymology as the main objective. In this search (Table 7), *ASCA* scored much better than *CBAC*, possibly because some of the papers were considered to be outside the scope of *CBAC*. *CBAC* retrieved four papers which did not have the words 'carbonic anhydrase' in the title, though these were on the whole less interesting—this is a field where titles are fairly meaningful. *CBAC* missed five abstracts of papers read at meetings and reported in Federation Proceedings, and six others for no apparent reason.

To summarize the results obtained so far, it seems that, because it covers fewer journals in the specialized field of chemistry, *ASCA* will always produce a smaller number of references for a chemical search than a corresponding search in *CT*, but on the other hand in a fringe topic its wider subject coverage may give it an advantage. *ASCA* is weakest in its coverage of Japanese and Russian journals, but it also omits some quite important western journals, for instance *Ann. Chim. (Rome)*, *Gazz. Chim. ital.* and *J. Organometall. Chem.* (although these are all in *Index Chemicus*); it seems to be biased in favour of English language journals. Both services missed a number of papers for no apparent reason; for *CT* we checked the printed editions and confirmed that the papers in question were missing from them too.

There is little to choose between the timing of the two services; *ASCA* reaches us very regularly every Monday or Tuesday by airmail, whereas computer teething troubles have led to somewhat irregular deliveries from Nottingham. The *ASCA* print-out comes on 7 by 11 inch sheets (two copies), which are more convenient to handle than the bulkier Nottingham output, but on the other hand *ASCA* prints out all the references on one sheet although they may represent several searches. This is an indirect result of the *ASCA* costing system: there is a minimum charge of $100 per year, which will cover up to fifty citations or twenty-five alternative terms depending on the frequency of the terms chosen, so that it is more economical to group a number of independent searches into one combined profile.

One other important difference between the *Chemical Abstracts* journals and *ASCA*, which has influenced in particular our approach to problems of search strategy, has been the fact that we have had continuous help and advice from Dr Kent and his team at Nottingham, for which we are very grateful. Because they encouraged us to experiment, and also warned us of pitfalls, we were able to make far better use of the facilities than we would otherwise have done. This sort of personal contact is very important in information work.

Conclusions

In these three services, *CT*, *CBAC* and *ASCA*, we have the most sophisticated alerting services available to chemists. How useful are they going to be to the information department, or to the individual chemist?

The factors which will decide their usefulness are the completeness of coverage, the relevance of the output, the acceptability of the format, and the timeliness. For the information department, completeness is very important, and it is still more important to know what has been left out—what exactly are the selection rules applied to fringe subjects. It will be clear from my earlier remarks that I do not feel that a pure title search will ever give sufficiently complete retrieval: the future lies either with titles enriched with carefully chosen keywords or with the digest system used in *CBAC* (and in *POST*). Relevance and format go together: low relevance can be tolerated if it is easy to select the relevant material from the output. Even for an information department, material not strictly relevant is likely to be useful in unexpected ways. However, I think the relevance of *CBAC* searches might be improved if it was possible to search each paragraph of an abstract as a separate unit, and also if the abstractors gave more thought to retrieval problems.

The importance or otherwise of the time of arrival of an alerting service depends on the way it is used. If it is efficient enough in other respects to supersede the routine scanning and indexing of common journals, then it must be available within a week or two of these journals. On the other hand, if it is used only to supplement the regular reading of the more important journals, time is less vital: effectively the computer service is competing with scanning of *Chemical Abstracts* or other secondary journals.

For the individual chemist, whether in an industrial or an academic environment, completeness of retrieval is less important. The individual is looking for a selection of papers in his own subject, papers which will tell him what is going on but also may give him new ideas, and he can feel well-informed and probably get as much as he needs out of a less complete search. If he has every paper on his subject, he may well feel bogged down. In the same way material which strictly speaking is 'irrelevant' may be very useful to him: it should have had some bearing on his subject in order to be retrieved (I am excluding real false drops), and may start off a new train of thought. Format is important to the individual (cards are probably the best). Timeliness is less important, except that he may be irritated by a reference to a paper he has already read two months earlier—in other words, well-known journals should be covered fast but more obscure ones need not be. (Of course, we are talking of potentially international services, and one country's 'obscure' journal is another's main publication.)

The point of view of the chemist is rather different from that of the biologist: generally the chemist has a greater need for specific, detailed information about particular compounds, and the biologist a greater appreciation of general background material.

There is an important distinction between alerting systems and retrospective retrieval systems. For retrospective retrieval the search covers an enormous volume of literature and has fairly well defined objectives, so that high relevance is both desired and expected. On the other hand, in alerting the volume of literature available each week is much smaller, and the objectives are less clear: new aspects of your subject are opening up all the time.

The individual's reading of original literature serves a multitude of purposes. Besides acquiring specific information on his own subject and background information relevant to it, he may notice some small detail of technique or theory in a quite unrelated field which he could adapt to his own purposes. He may also become aware of some problem area into which he could move, some new field he could study. He will also pick up a general background knowledge of the whole field of chemistry—what is being done, where and by whom—which is part of his education.

Now computer-based information services (or the more conventional services of an information department) can only do a limited part of this for him, so that he must still be encouraged to spend some time reading the more important original journals. As the volume of significant literature grows, and the proportion of it which he can find time to read shrinks, he must rely increasingly on someone else to select from the journals he misses the papers which would have interested him. This, in my opinion, is the proper function of computer-based alerting: to provide a personal journal which the individual can use to supplement his reading, but which will not necessarily contain either every relevant paper or nothing but relevant papers. With a current awareness service, you are looking not only for factual knowledge but for inspiration.

Parameter 1	Weight 100	ELECTROC*
	100	ELECTROS*
	100	KOLBE
	50	ELECTROL*
	50	ELECTROD*
2	50	COUPL*
	50	REDUCTI*
	50	OXIDATI*
	50	SYNTHE*
3	—60	POLARO*
	—60	PLATING
	—60	PRECIPITAT*
	—60	*STATIC
	—60	DEPOSIT
	Threshold Weight 100	

FIG. 1. *Profile for 'Electrochemical Synthetic Methods'*

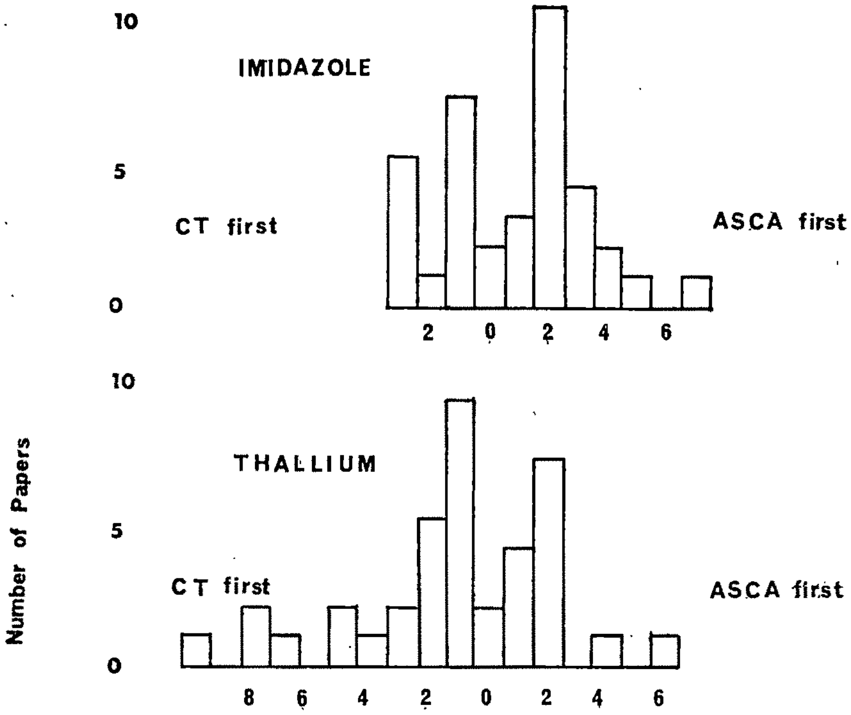

Fig 2 Time interval in weeks between CT and ASCA

References per issue	*Number of profiles*	
	CT	*CBAC*
0–1	9	3
1–5	6	7
5–10	6	3
10–20	0	6
20–30	2	1
30–40	1	0
	24	20

TABLE 1. *Size of output*

Profiles based on a chemical concept: 9, 30, 32, 33 and 50%	Average: 31%
Profiles based on a biological concept: 24, 30, 44, 65, 68 and 81%	Average: 50%

TABLE 2

Proportion of relevant CBAC papers which could have been found by title

Proton magnetic resonance of some diazoles, triazoles and tetrazoles.
Photochemical reactions of pyrazine-N-oxides.
Cycloaddition reactions of mesoionic oxazol-5-ones.
The photorearrangement of 2,3-dihydropyrazines.
Origin of the nitro group of azomycin.
A new class of highly cytotoxic compounds.
Clinical experiences gained with a new antihypertensive.
Histamine analog effect on the ureter.
Effect of dimetridazole on rate of gain and feed efficiency in swine.
Inhibitors of microbial L-histidinedecarboxylase.
The effect of acetylation on the activity of rabbit muscle fructose diphosphate aldolase.

TABLE 3. *Some papers on imidazole*

Search term	*CT* *THALL*	*ASCA* THALL*
Found by both systems	36 (7 organic, 1 toxicology)	
Found by this system only	91 (12 organic)	28 (3 organic, 2 toxicology)
Including false drops	5 (e.g. lethally)	3 (e.g. thallophytes)
Thallium papers missed	25 (3 organic, 3 toxicology)	40† (5 organic)
Reasons for omission:		
journals not taken	10 (2 toxicology)	21** (3 organic)
Russian + transln.	4 (1 organic)	1
missed because of truncation		2 (1 organic)
had appeared earlier in *CT*	3	
might appear later in *CT*?	1	
abstracts, reviews	2 (1 organic)	
no explanation	5 (1 organic, 1 toxicology)	16 (1 organic)

TABLE 4

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† Using only *CT* 10–16, i.e. discarding the first and last six weeks.

** These included thirteen Russian and five Japanese papers.

	CT		*ASCA*
Search term	*IMIDAZO*		IMIDAZ*
Found by both services		36	
Found by this service only	45[†]		8
Missed by this service	8		23[**]
Reasons for omission:			
journal not taken	2		5
Russian journal in transln.	2		5
abstracts (Fed. Proc.)	2		
no explanation	2		2
could not be retrieved because of term truncation			11

TABLE 5

[†] Benzimidazoles and napthimidazoles were excluded.
[**] For *CT* 10–16 only, i.e. excluding the first and last six weeks.

. . . 1-alkyl-2-aryl-5-chloroimidazoles.
. . . . . a new triazenoimidazole.
. . . . . 2-oxoimidazolid-3-yl . . .
Improved synthesis for N,N′-thiocarbonyldiimidazole.
Periodoimidazole.
. . . . . bisimidazoline.
The production of 2-methylimidazole.
Crystal structure of hexaimidazole zinc dichloride.
N-Dibenzylphophorylimidazole.
6-Phenylimidazo (2,1-b) thiazole.

TABLE 6. *Titles retrieved by* CT *which could not have been retrieved by* ASCA

	CT	*ASCA*
Search term	CARBONIC ANHYDRASE	CARBONIC ANHYDRASE CARBOANHYDRASE
Found by both systems	8	
Found by this only	8	18
Missed by this:	18	8
journal not taken	2	
term not in title		4
abstracts (Fed. Proc.)	5	
might appear later in *CBAC*? (*ASCA* after 7th July)	5	
might have appeared earlier in *ASCA*? (*CBAC* before 5th May)		4
no explanation	6*	

TABLE 7

* Three of these have appeared in *CT*.

DISCUSSION

Mrs C. Philip (BP Trading) commented that using the NOT logic technique did not mean that the exclusion of subject matter B automatically excluded papers covering both subject matter A (that you want) and B (that you do not want).

Dr A. Kent (Chemical Society Research Unit) said that NOT logic could be mimicked by negative weights, and searches could be designed so that the negative weights did not exclude papers which simultaneously included wanted and unwanted concepts.

Mr A. Davey (Allen & Hanbury's) said that a previous speaker had referred to the need to give abstracts in the form of key-word lists; it was interesting to note that at least one journal had gone some way towards this. This was the *Journal of Experimental Analysis of Behaviour*, which contained a tear-out card for each article.

Letter to the Editor

LOGIC OF CO-ORDINATE INDEXING

Dear Sir,

It is a healthy sign that the activities of the Co-ordinate Indexing Group should generate lively correspondence: one would not wish it otherwise.

But, sir, I believe that our eyes must be as much on future concepts as on past precepts. The very early industrial chemists managed without electrons and nuclei and many other such ideas, but industry is not the worse for their exposure. Possibly, it did mean that, gradually, entrants needed skills different from those of their forebears. This is one of the prices of progress. Who, in a couple of centuries, will not need to be as generally familiar with the computer as you and I are with the motor-car?

If you will permit me to lapse into the language of the stud book, winners are often by 'Postulate' out of 'Bitter Experience'. The filly is a good stayer, and a sagacious runner, particularly when the going is heavy. But 'Postulate' has a notable turn of speed on the straight, and has been known to relish fences that 'Bitter Experience' has refused. The wise punter will watch both animals.

Our *daily* work may well not require frequent excursions into theory. But who has not, on occasion, wished that he could discern what general truth lay beneath some 'dodge' that he had devised? Those who theorize seem, by custom and perhaps by necessity, to have been permitted some license in terminology. Are we to be so craft-conscious that we repel the theoretical approach because it brings with it language that is at first esoteric? Was not 'co-ordinate indexing' itself an esoteric term once upon a time? How many disciples are needed for de-esoterization?

'How we might' is a proper complement to 'how we did'. Sometimes it even tells us '*why* we did'. Permit me to convey my respects to your contributors.

Yours sincerely,

W. E. BATTEN.

41 Gordon Place,
London W8.
29th January 1968.

This correspondence is now closed.—Editor.

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ALL ITEMS listed may be borrowed from the Aslib Library, except those marked *, which may be consulted in the Library.

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MEMBERS' ADVERTISEMENTS

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The Director of Research,

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**Editor/Compiler required
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WE REQUIRE an editor to revise an existing directory of Soviet scientific establishments and compile new entries. Publication is expected towards the end of this year or early 1969. Access to a comprehensive range of current and recent Soviet journals would be essential but apart from this the work could be done at home on either a part-time or full-time basis. A knowledge of Russian and transliteration methods is desirable. The editing/compiling work is expected to take from six to nine months. A generous fee will be paid. Those interested are invited to write in confidence to our managing director at his private address: T. Tocd, Villa Magnol, Fosse André, St. Peter Port, Guernsey, C.I.

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ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 **March 1968** **Number 3**

ASLIB CALENDAR 1968

March

WED.27.	Engineering Group meeting at Birmingham. (See paragraph below.)
FRI.29.	Scottish Branch annual general meeting and conference at Glasgow.

April

FRI.5 – SUN.7.	Transport/Aeronautical Groups joint conference at Cranfield.
MON.8 – TUE.9.	Course on business information at Birmingham.
TUE.23.	Second Aslib Annual Lecture, by Sir Frank Francis.
THU.25 – SAT.27.	Northern/Midlands Branches joint conference at Scarborough, Northern Branch annual general meeting at Scarborough.

May

WED.1.	Engineering Group annual general meeting, at Aslib.
TUE.14.	Economics Group annual general meeting.
WED.15.	Course on advanced patents: opposition, at Aslib.
THU.23.	Evening meeting at Aslib. Patent agents' work for industry, by Mr J. A. D. Cropp.
TUE.28.	Engineering Group evening meeting.

June

FRI.21 – SUN.23.	Electronics Group conference at Berkhamsted.
THU.27.	Transport Group visit to Cement and Concrete Association.

September

SUN.22 – WED.25.	42nd Aslib Annual Conference at Canterbury.

Northern Branch

An annual branch conference, in conjunction with the Midlands Branch, is to be held by the Northern Branch at the St Nicholas Hotel, Scarborough, from the evening of 25th to lunch on 27th April 1968. Further details will be circulated when available.

The 21st Annual General Meeting of the Northern Branch will be held on Friday 26th April 1968 at the annual branch conference. Details will be circulated later.

Aeronautical Group

The seventeenth annual conference will take place at the College of Aeronautics, Bedford, from Friday 5th to Sunday 7th April 1968. This year the event is being held in conjunction with the Transport Group.

Several talks will be given. Mr V. J. Rogers of TIL will speak on Production of printed indexes to R *&* D *Abstracts*; Mrs Mongar of the Road Research Laboratory will describe how *Road Research Abstracts* produced in conjunction with the OECD Scheme of automation; Mr C. G. Giles, Head of Information 2, Mintech, will delineate the recently introduced information structure of the Ministry; Mr R. L. Trillo of Hovermarine will give a lecture entitled 'Comparison of hovercraft economics'; on Sunday Mr S. Hudson of the British Standards Institute will give a paper entitled 'Standards for documentation', and in the afternoon Mr M. Robinson of the Motor Industry Research Association will describe the Association's information service.

The Conference Dinner will be held as usual on the Saturday evening and the annual general meeting on the Friday evening. Further details are available from the conference secretary, Mr E. J. MacAdam, Librarian, Aeronautical Research Association, Manton Lane, Bedford.

Engineering Group

A meeting on 'Recent developments in modern production techniques' will be held at the Engineering and Building Centre, Birmingham, on Wednesday 27th March, starting at 6 (for 6.30) p.m. The speakers will be Mr R. R. Jeal and Mr R. Wander, both senior lecturers on production methods at the Production Engineering Research Association.

For further details please contact Mr B. R. Styles, Technical Librarian, Ministry of Public Building and Works, Leatherhead Road, Chessington, Surrey.

Course on Indexing

A course on indexing has been arranged by the Society of Indexers in conjunction with the School of Librarianship, North-Western Polytechnic, and will be held from Monday 1st to Friday 5th April at the School's new premises, 207–225 Essex Road, London N1, near the Essex Road Underground station.

This is the seventh such course, and will be on similar lines to those previously arranged; it will include instruction in the indexing of books, periodicals, documents and other materials. Recent developments in the field of mechanization will also be discussed.

The fee is £4. Full particulars and forms of application to attend may be obtained from Mr L. M. Harrod at the School.

Computer-based Information Retrieval Systems

A course on computer-based information retrieval systems will be held at the Liverpool College of Commerce on Thursday 18th and Friday 19th April. The fee will be £5 5*s*.

Further information may be obtained from the School of Librarianship and Information Work, Department of Professional Studies, College of Commerce, Tithebarn Street, Liverpool 2.

Progress at BSI on the English Full Edition of UDC

The British Standards Institution national committee for UDC, under the chairmanship of Mr J. E. Wright, the Aslib representative, has set itself a firm target to complete the English Full Edition of UDC by the end of next year. It is recognized that this will involve publishing some out-of-date schedules, and that the sections will necessarily be inconsistent, but it has been agreed that this task should nevertheless be completed, as it will provide a foundation on which all those in this country concerned with the application and revision of UDC can build and, through BSI, ensure that the United Kingdom is well represented in the continuous revision of the classification through FID Committees, and closely involved in research as to its applications, including the use of computers.

The following unpublished sections of the English Full Edition of UDC are being actively processed at BSI and are at the stages indicated:

UDC 1 UDC 2	Philosophy Religion	The schedules have been translated and a reconstituted BSI panel is currently checking them
UDC 3	Social Sciences	The schedules have been largely translated and a new BSI panel is now meeting to check them and to ensure close liaison with FID/C 3
UDC 61	Medical Sciences	This will be published in eight separate sections; all the schedules have been finalized and most of the indexes completed Each section is at proof stage
UDC 613	Health & Hygiene	Will have been published in February/March 1968
UDC 624	Civil Engineering	At page proof stage with index
UDC 625/627	Railways, highways and water transport	The BSI panel is currently meeting and checking the translated schedules for publication
UDC 628	Public Health Engineering	At page proof stage with index
UDC 629	Transport vehicles	At page proof stage
UDC 63	Agriculture	A new BSI panel has nearly completed checking the translation made last year by the Ministry of Agriculture, and a start has been made on the index

UDC 65/651 & 657/659	Management	At page proof stage with index
UDC 655 UDC 681.6 UDC 686	Printing Printing machines Stationery	The translated schedules are being checked by a newly reconstituted BSI panel
UDC 656/656.7	Transport services	At page proof stage
UDC 66	Chemical industry and technology	The translated schedules are being checked by a reconstituted BSI panel and the remainder are being translated
UDC 677	Textiles	The BSI panel is meeting in Manchester this spring for a final check of the translated and indexed schedules
UDC 681.3	Data processing	At page proof stage
UDC 681.8	Musical instruments & Acoustics	The translated schedules have been checked and an index is now being prepared
UDC 684	Furniture	At page proof stage with index
UDC 688/689	Fancy goods, toys, hobbies	The translated schedules are being checked by the BSI panel
UDC 7/72	Architecture	The translated and checked schedules are now being indexed
UDC 73/76	Art	At page proof stage with index
UDC 77	Photography	Will have been published in February/March 1968
UDC 78	Music	The translated and checked schedules are now being indexed

Dr H. Coblans

Members will wish to know that Dr Coblans will be away from Aslib from 1st March until the end of June. During this period he will be working on behalf of Aslib at the International Atomic Energy Agency in Vienna, where he will be leading an international team, developing plans for an international nuclear energy information service (INIS).

REVIEWS

CHANDLER, G. How to find out: a guide to sources of Information for all arranged by the Dewey Decimal Classification. 3rd rev. ed. Oxford, Pergamon, 1967. xiv, 198. 25*s*.

The third edition of this guide appears to differ little from the second, revised edition published in 1966. Some altered illustrations are included and the additional publications (nearly 100) are in most cases merely listed in their respective sections, but evaluation would have been more helpful.

The guide would be much improved if the dates of the reference material and the frequency of publication of the periodicals were given. It also, regrettably, continues to list superseded reference works and defunct titles. In the preface the author excuses this by stating that most of the suspended publications are still of current value and that dates have been omitted because many works are constantly revised. The result of this policy is that each 'new' edition is more out of date than the last.

HARVEY, JOAN M. Statistics—Europe: Sources for market research. Beckenham, Kent, C.B.D. Research Ltd., 1968. xii, (170) p., 60*s*.

This directory is up to C.B.D.'s usual high standard in content and presentation. It includes information on the main official statistical centres, with details of their coverage and services. Libraries where national publications can be consulted are shown in the country concerned, and also in the United Kingdom, Australia, Canada, New Zealand and the USA. Bibliographies are listed, as well as the details and type of contents of the regular statistical bulletins, year books and other publications.

The author, formerly in charge of the Board of Trade Statistics and Market Intelligence Library, is very competent to produce such a reference work, and librarians, economists and market research workers will find this very useful.

World of learning 1968–9. London, Europa. 170*s*.

This is the eighteenth edition of the *World of learning*. The size is increased by over one hundred pages and the price is increased by one pound.

Last year the publishers placed the Learned Societies and Research Institutes of some countries under classified headings and this useful arrangement has been adopted for five more countries. Only the English names of the large number of USSR societies and institutes are given and it would be useful to know the original language title as well.

It is not clear if the information included is based only on replies sent in by each place. The editors do not appear to make any effort to note recent changes themselves. For example, the National Reference Library for Science and Invention (Holborn Branch) is still listed as the Patent Office Library, and the address of the Royal Society is still given as Burlington House.

Mr B. Agard Evans

When a colleague retires, the hope is often expressed that he will continue to take an active interest in that field of professional work with which his name has become associated. In no case can this hope be expressed with greater confidence than in that of Mr Agard Evans, the author of our second article this month, who has chosen to mark his retirement with a successful piece of work as UK member of the Expert Group whose work he describes.

Mr Evans entered the information field in 1935 as Assistant Librarian at the Building Research Station. From 1936–9 he was Librarian of the Road Research Laboratory and from 1939–44 Records Officer in the ARP Research Dept. of the Ministry of Home Security. He held the post of Chief Librarian of the Ministry of Works from 1944 until he retired in October 1967. He was awarded the OBE in 1961 and has given distinguished service in the building documentation field.

Mr Evans became a member of the Council of Aslib in 1944 and served as Deputy Chairman 1952–3 and Chairman 1953–5. He was also a member of the Council of the British Society for International Bibliography until the Society merged with Aslib in 1949. He was at one time Honorary Editor of *Aslib Information*, served extensively on the Executive and Finance, International Relations, Publications, and Education Committees, and was Chairman of the Publications and Editorial Committee 1945–7. He has also served as Chairman of the Engineering and Furniture Groups and has contributed several articles to this journal.

Mr Clive Sabel

We are sorry to report the recent death of Mr Clive Sabel, who is known to Aslib members chiefly through his work on the Committee of the Aslib Mechanization Group. Mr Sabel came into information work in November 1955, when he joined the information office at Harwell. In 1960 he moved to the Culham Laboratory as Information Officer, and in 1963 became Senior Information Scientist at CEGB.

Mr R. Brightman

The death has also occurred of Mr R. Brightman, formerly Division Bibliographer of ICI Dyestuffs Division, and honorary member of Aslib since his retirement in 1955. He was first elected to Council in 1935 and served again on Council from 1949 to 1953, and on the Conferences and Meetings Committee from 1948 to 1950. Mr Brightman played a leading part in the formation of the Northern Branch and was its first chairman.

An Industrial Patent Agent Looks at his Work

At the evening meeting at Aslib on Thursday 23rd May 1968 the chair will be taken by Miss M. F. Webb, Keeper, National Reference Library for Science and Invention, and a Chartered Patent Agent, working in one of our large industrial concerns, will discuss some aspects of his job and of the patents system within the framework of which he has to work. He will indicate analogies between the methods of the information officer and those of the patent agent, particularly with regard to information retrieval. Among other matters he will consider the procedures involved in the examination and publication of patents and possible ways of speeding up the process, including mechanization.

Members wishing to attend this meeting are asked to notify the Meetings Organizer, Aslib, *not later than 24th April*, and to note that, apart from a brief reminder in next month's calendar, there will be no further notification about this meeting.

GHILLYING FOR SCIENCE—ROD OR NET?

W. E. BATTEN

Head, Central Technical Information Unit, Imperial Chemical Industries, London

Paper presented at a Scottish Branch Meeting, Wednesday 13th December 1967

I SUPPOSE the first duty of a hunter's servant is to know what kind of quarry the laird is looking for. In the great field sport of information, I often think that we serve a remarkably inarticulate gathering of lairds. True, he will probably specify fish or fowl, but he leaves you to guess whether he wants a fine trout or a shoal of minnows. The statistical laird (if we may invent so unlikely an abstraction) needs either, of course—and at his own choice; but even so you usually have to be a thought reader before you reach for the rod or the net, as the case may be.

However, having bagged our own little grouse before the shoot really starts, let's take a critical look at the gun room and ask ourselves whether we are making proper complementary use of the bow and arrow and the rocket.

Let us make the assumption that a human investigator, having noted a reference or references in whatever indexes he can lay hands on, does not usually pass his findings to a serious inquirer without *some* examination of the document or of an abstract. He does not, of course, read every word; but he senses, rather than reads, the scope and depth and emphasis of the reference—sufficiently to decide whether the inquirer should be advised to spend time on it. Only rarely will he be able to proffer the reference as being a complete resolution of the problem. He is in the position of being a literature consultant: he *recommends* certain matter for reading. I am, of course, speaking of the 'special librarian' as we normally understand that animal—not of the literature assessor, who may stand much closer to the real problem and be actively and regularly associated with the project.

Now the computer, which is being so frantically pressed into service, does not have this remarkable gift of omni-directional perception. Its intrinsic perceptual powers are those of a one-dimensional, one-eyed worm peering through an extremely narrow slit. But, of course, it *is* a very agile worm, and it can turn exceeding fast—much too fast for even the earliest bird. So, if we can organize things so that it is given a very rapid sequence of glimpses, it is capable of apparent recognition of the whole object—rather in the manner of a television camera. Even so, the totality of its recognition does not exceed the sum of its individual glimpses. It might be programmed to recognize a bottle with a good Highland name on it, but its eye would not brighten and its salivary glands would not be stimulated. Furthermore, the features that it acknowledges must have been prescribed and codified beforehand by the programmer so that the machine is explicitly warned to look out for them. Similarly, any responses that are desired to be made must also be prescribed—as in other forms of ritual!

In our development of aids for the human searcher, we have found ourselves caught up in the conflicting demands of 'relevance' and 'recall'—and have thereby come up against a further manifestation of our inability to serve both God and Mammon. Try as we will, whatever we do to improve recall degrades relevance, and vice versa. This unhappy frustration did not afflict the unaided but skilled human searcher—it is a psychosis of the computer age—and it is worth a moment's reflection to try to find the root of the human operator's undeniable superiority.

What I now have to say is, I fear, incapable of proof, but I suggest that the superiority of *hom. sap.* is founded in his ability to apply two different intellectual forces almost simultaneously. He applies an ability to select and an ability to reject in rapidly alternating succession. Nor does he perform these functions by the mere optical recognition of symbols. Some integration and interaction between the various observed symbols goes on in the brain and mind of the searcher during both the selecting act and the rejecting act. I cannot helpfully call these acts 'phases', for they are not always clearly separate and distinct. To make the whole process still more complex, there is continual mental interaction between the searcher's understanding of the question and his momentary appreciation of the reference.

Now, programming cannot yet be brought to the point of reproducing such a degree, such a quality, of mental analysis. In fairness to programmers, let us admit that this is primarily because we cannot explicitly enumerate all the steps in the complex mental process that I have tried to outline. And even if we could, it would probably involve such a volume of symbolism that I doubt whether an individual programmer would live long enough to write the program or whether the core store could possibly contain both the program and the material to be processed.

Even so, does not our brief examination of the human searching process suggest that in any mechanized (or mechanically-aided) search system, there must be some co-operative and beneficent interplay between something that I will call 'gathering power' (the net) and something that I will call 'discriminating power' (the rod). I believe that we may have witnessed the emergence of these two forces—in a rather naked and primitive isolation—(*a*) in the shape of the very simple co-ordinate index with a very compact thesaurus, and (*b*) in the shape of so-called free-text searching.

The former can indeed be a net—a veritable trawl! It can bring up almost anything from blue trout to red herrings *unless* the thesaurus is composed and used in a highly creative and imaginative way. The latter is indeed a rod—with a fine line and a parochial fly. It can bring up practically nothing *unless* handled with very great dexterity and finesse.

My poor piscatorial analogy is admittedly rather far-fetched and I will not pretend that the allegorical journey was strictly necessary. But we are laboriously approaching the Devil's Elbow!

I am becoming reconciled to the notion that the simple co-ordinate index on the one hand, and free-text searching on the other, represent the ranging shots in the battle against disorder and that the effective form of attack must lie somewhere in between or, more likely, in a combination of the two techniques. It is fairly evident that co-ordinate indexing with a short thesaurus has effective 'gathering power'. And what it gathers (leaving aside the so-called 'false drops') is *prima facie* relevant—that is to say, relevant in a purely linguistic sense though not necessarily relevant in a meaningful sense. It is also fairly evident that free-text searching (as evidenced by word for word searching in abstracts and digests) has effective 'discriminating power'. That is to say, that what little it picks up, when responsibly used, is acceptably relevant in a meaningful sense.

Now, we must make a short diversion into the Slough of Despond to observe a strange and awkward twist of fate. It so happens that the simple thesaurus—the thing with gathering power—has been mainly used for retrospective retrieval where, however, real discrimination is needed because the potential yield of references is large. By a similar application of the law of cussedness, the free-text technique—the thing with discriminating power—has been mainly used for current awareness, where close discrimination is less important because the potential yield of references will inevitably be limited. We have thus the unfortunate situation that the two techniques have both been applied in the very situations that respectively suit them least. Of course, there is a rational explanation for this. Current awareness has to be 'current'. The free-text system requires no intellectual analysis at input, and the search aids can therefore be produced without undue delay. The controlled thesaurus system, however, requires intellectual analysis, and the retrospective retrieval operation can tolerate the processing delay.

The information profession will not, we may be sure, remain complacent with the present state of the art, but, it seems to me unlikely that fundamental work on symbolisms for the expression of whole ideas can provide an early operational solution. Nor do I see how advanced computer technology alone can break through the impasse. Either line might lead to an informative paper solution; but the cost of its implementation could be frightening.

The ball is, I think, plainly at the feet of the more progressive of the practical information workers: to argue out a reasonable pragmatic compromise to serve us for, say, the next decade. Such an expedient will not turn its back on the computer, nor will it demand even more human analysis. It must, before all else, strive to keep cost down by rendering to the computer the things that are the computer's, and rendering to man the things that are man's. And it cannot assume that the average user will have ready access to an on-line, direct-access, immediate-response system, even if cost considerations favoured this approach.

What line of development should such a compromise solution follow? I can do little more, within the compass of this paper, than set out, as I see them, the considerations that apply to the human contribution, and those that apply to the machine contribution. I would, however, hope that if such thoughts can be developed into an exhaustive statement that is generally acceptable to responsible documentalists, that we might then begin to look forward to some convergence and conservation of development effort—even allowing for the fact that all information situations differ in local detail.

Human skill is characterized by high and rising cost and by its superiority at recognizing the conceptual and the relational elements that together comprise an idea. This skill has been largely displayed in classification, in controlled indexing and in browsing. The human is not notably skilful at mere symbol recognition, nor at symbol manipulation, where fatigue and lost concentration give rise to purely mechanical errors. In any event, pure symbol shifting is as spiritually empty as other forms of fetching and carrying.

Machine skill is characterized by falling unit cost and rapid and accurate symbol shifting. But no recognition of meaning is yet possible save by the costly introduction of a much greater volume of symbol shifting to accommodate the instructions themselves and the required responses.

There will be a shadowy area in any total information process where the two alternative servants must roughly break even and where opinion and expediency must continue to have the decision. Equally, there must be two areas where, respectively, the man and the machine should be dominant. We shall have made some progress if we can define and describe these two areas in terms of the common elements of information handling.

Leaving aside purely library operations (where I believe the computer's proper share of the burden may be almost self-defining) my own limited understanding of this immensely complex semantic problem suggests that human document analysis must be retained to ensure that documents are 'placed' (a term that will have to serve me for both classification and indexing) in accordance with their 'idea content', and not solely in accordance with their overt symbol content (or even their explicit concept content). The results of this human effort can, provided the language and symbolism be properly disciplined, then be applied most efficiently by machine: for either transient or permanent display: for either conventional use on paper or for conversational use at the console.

This initial human contribution has the effect of making the total collection divisible, on command, into a very large number of specifiable sub-collections possessing an *ad hoc* homogeneity. These sub-collections may, we know, have poor relevance when judged against a particular question, but recall rather than relevance should be the primary aim of this part of the operation, because its product is destined for further refinement.

Sometimes, the sub-collection will be so small that further human analysis will be literally the cheapest way of sifting out what is really relevant. Sometimes, however, the sub-collection will be much too large for immediate human treatment, and it is for such cases that one is driven to ask what further assistance the machine can offer.

Now my conversations with colleagues in the UK and elsewhere are hardening my conviction that 'free-text searching', although a rather poor way of assembling a surrogate around an idea, is not at all a bad way of discriminating amongst the members of a surrogate that already possesses reasonable homogeneity. To take a fictitious, and rather puerile, example. Once you know for sure that you are strictly in the field of flip-flop circuitry, it may be quite sufficient to cry 'Smith'—without initials—to get what you want. But to cry, shall we say, 'Grant' to the *Encyclopaedia Britannica* would leave you wearily plodding through history, geography and social economics with your thirst still unslaked.

If cost will stand it, a co-ordinate index, followed by a free-text search of good abstracts or digests seems to me a practicable compromise for large collections. Depending upon the inquiry situation there could be iteration between inquiry and system at the half-way stage. This could result in a better posed question at the second stage, or even to a withdrawal or modification of the original question.

Cost again would determine the details of such a scheme. I would foresee two computer files as separate entities, since abstracts would get in the way during the initial co-ordinate search phase. Input could presumably be a single operation, the human analyst adding his descriptors to the abstract; the program could separate the two forms of input and direct them to the appropriate files. It might be debatable whether the *whole* abstract should go forward to the Phase II file. Bearing in mind (*a*) that an abstract usually has to be typed at least once during preparation, and (*b*) that having the full abstract on the file enables it to be printed out as a response, and (*c*) that the full abstract permits sentence-by-sentence examination, I am inclined to plump for the full abstract. If you have less, then the abstract itself must be carried in a third file which, however, need not be magnetic, but could be microform or paper.

It has to be admitted that adoption of such a two-level approach could do considerable violence to the concept of tailor-made current awareness, or SDI as it is popularly called. But how current must current-awareness really be? There are always some special cases of extreme urgency; but is there a general case that is so strong as to outweigh the co-occurrent advantages of (*a*) SDI and retrieval from a single system, (*b*) better recall in SDI, and (*c*) better relevance in retrieval? I believe that this question should be objectively examined before divergence between the two techniques carries them out of one another's reach. Certainly 'current awareness' is the great talking-point against an intellectual input treatment. And yet, if current awareness is to be suggestive as well as informative, an analytical input treatment is needed. If speed is the dominant and overriding criterion, would not a collection of contents pages provide acceptable statistical satisfaction, bearing in mind its cheapness?

I have, as I threatened, brought you to the Devil's Elbow. But alas: we are in a snowdrift! Do you dig it? More power to your elbows, poor devils!

THE PROPOSED WORLD INSTITUTE FOR DOCUMENTATION OF HOUSING, BUILDING AND PLANNING

B. AGARD EVANS
formerly Chief Librarian, Ministry of Public Building and Works

Paper presented at Aslib Meeting, Tuesday 23rd January 1968

1 PREFACE

BEFORE embarking on this paper, I want to make an emphatic disclaimer. In so far as the proposed Institute has political angles, these are expressly excluded from my treatment. The Expert Group had fairly wide terms of reference, but these were regarded as professional or technical questions and answered factually.

I propose to rehearse to you the problems which the Group considered and briefly how we reached the solutions which we put forward. There are, at practically every stage, alternative routes which may be followed; but, in order to reach a concrete estimate of staff and cost, it seemed better to select a basic plan and to consider the practical requirements for its fulfilment. It is at least unlikely that the Institute will be born in precisely the shape conceived, or spring, like Aphrodite, full-grown from the waves.

I look forward to much constructive criticism from the distinguished audience tonight; and I hope that the report of the Expert Group will be discussed in many countries, so that when the time comes for its implementation, there will be ample material for the organizers to base the Institute on firm foundations, in the interests of all potential beneficiaries.

2 INTRODUCTION

For a good many years the United Nations has had a Centre for Housing, Building and Planning, which has carried out a programme of considerable benefit, particularly for the under-developed countries. It has provided the Secretariat for and been advised by the Committee for Housing, Building and Planning, which is a committee of ECOSOC (Economic and Social Council of the United Nations).

For a number of years it had its own documentation unit in the form of the Building Reference Centre, organized and run by the late Miss Ellen Schoendorff. It became clear, however, that a more comprehensive organization would be needed to handle world documentation on an adequate scale in this large field, if information concerning developments in one part of the world were to be made readily available to practitioners in other parts.

International organizations were in existence, and within their limitations were stimulating the publication and exchange of experience; but lack of resources and facilities prevented their exercising a systematic and comprehensive survey of world information.

In August and November 1966, ECOSOC took note of the Secretary-General's Report (E/4275); approved in principle the proposed establishment of an International Institute for Documentation on Housing, Building and Planning at New Delhi; but desired that a more detailed technical report on the functions and operations of the Institute should be prepared, which would also provide the basis for a more precise estimate of financial needs.

An Expert Group of the following four persons was accordingly appointed by the Secretary-General:

Mr Prem Krishen	(India)	Chairman
Mr B. Agard Evans	(UK)	
Mr Michel Courtier	(France)	
Mr Miroslav Polidar	(Czechoslovakia)	

The Expert Group met at the UN Headquarters in New York from 10th to 21st July 1967 and again from 21st to 31st August 1967 at New Delhi. A unanimous report was submitted to the Secretary-General on 7th September 1967.*

The Report was favourably received by the Committee on Housing, Building and Planning meeting in Geneva in October and the Committee put forward a draft resolution to the ECOSOC meeting in May 1968, recommending ECOSOC to instruct the Secretary-General to approach Member States for funds to begin the work of implementation in order to set up the Institute in New Delhi, starting with the establishment of an Advisory Board and a working party in Geneva to work on the detailed aspects of the preparatory phase.

3 TERMS OF REFERENCE

The terms of reference for the Expert Group were drawn widely, although requiring fairly precise answers to a number of questions.

In summary, the Group was required to define specifically the operational objectives and scope of activities, i.e. what service is to be provided, for whom?, and by what method?; to develop efficient and effective co-ordination with other organizations in the field; to make recommendations for the physical accommodation, its staff and equipment; to define the methods of printing and distribution of the documents resulting from the activities of the Institute; to determine the work of the Institute which could be covered by the permanent staff, as well as the necessity of appointing experts and consultants for various subjects; to recommend an organizational structure for the Institute, its relations with the Centre for Housing, Building and Planning at Headquarters and the functions and composition of the Advisory Board; finally, to estimate the capital cost of establishing the Institute and the current expenditure over the first three years.

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* ECOSOC E/C.6/78 Add. 1. 20 September 1967.

4 BACKGROUND DOCUMENTS

In addition to the terms of reference, the Group had before it: the Secretary-General's report to ECOSOC; preliminary papers from the members of the Group; the Indian Government's *Aide memoire* and offer of generous support; comments of Dr Luther Evans; comments by the CIB (International Council for Building Research, Studies and Documentation); and comments from URBANDOC, a demonstration project of the US Department of Housing and Urban Development, which is using a computerized system for storage and retrieval.

One of the most useful documents was produced by Mr Courtier at the first meeting. It consisted of several pages of close-packed questions on every conceivable aspect of the proposed Institute. It would have been a credit to the *Juge d'Instruction* examining a *cause célèbre* in French criminal circles. After a preliminary discussion we worked through this questionnaire for two–three days. The exercise helped all of us to clear our minds, identify the problems and appreciate the pattern that was emerging.

Both in New York and New Delhi, we paid visits to certain establishments and had the advice of experts on several of the problems as they arose.

By the end of the ten-day meeting in New York the basic plan for the Institute had emerged. In the interval before the second meeting data were assembled and proposals expanded. At the second meeting in New Delhi each aspect was considered again and the Report drafted.

5 THE PROBLEMS AND THEIR SOLUTION

(*a*) *Comprehensive or Selective?*

The first problem was whether to establish a world library of all relevant literature and sort it out by the latest gadgetry; or whether to exercise some form of selection. Two factors arise in this connexion:

(i) The relevant literature of a science, whether pure or applied, is all more or less relevant to the growth, development and application of the science; but a large proportion of the literature of housing, building and planning is diffuse, repetitive, unauthoritative and makes very little contribution to the total sum of knowledge. The assembling of a comprehensive collection would serve very little purpose and would be beyond the resources of the Institute to process effectively.

(ii) The majority of the 123 countries which the Institute would serve have not got extensive and sophisticated library and reference centres, capable of providing the original literature and translations, which alone could make a bibliographic reference useful to the practitioner.

Digests. These considerations led the Group to the conclusion that the main purpose of the Institute should be to produce a sort of *Readers Digest* in four languages, English, French, Russian and Spanish. Each *Digest* would give the gist of the document, with diagrams if necessary, so that the reader would not need to consult the original, save for exceptional cases where a full detailed study of the subject might be deemed profitable. Digests would be made of the best primary documentation available from world sources. It was thought that reasonable coverage would be obtained with one hundred *Digests* per month.

Annotated references. The *Digests* would be supplemented by the monthly issue of annotated references to documents which make useful contributions to the subjects, but do not merit the full treatment. The annotated reference will not be of the same immediate value to the practitioner as the digest unless he has ready access to libraries or reference centres from which he can obtain the original. Nevertheless, it will be a very useful guide and contribution to documentation centres.

Abstracts. The direct contribution of the Institute of digests and references in its field would be further supplemented by the republication of abstracts, prepared by other bodies and selected by the Institute as of value to its readers. These too would be translated and published in the four languages.

Syntheses. As the documentary resources of the Institute grow, a most valuable contribution may be made by the Institute by the preparation of syntheses of specific subjects. Each of these would be a review of a particular subject from a range of primary and secondary documents. Such an exercise might well help to reveal gaps in existing knowledge. The filling of the gaps could be undertaken by research centres, officers in the field or consultants.

(*b*) *Acquisition*

In addition to acquiring about a thousand titles of periodicals, the Institute would aim at a highly-selected collection of the best primary documentation. The criterion should be that documents admitted to the Institute's collection make a real contribution to their subjects and are likely to be helpful to practitioners in the field. Such limitation will bring the incoming material into manageable proportions for processing in depth.

Such selection is entirely feasible and can be greatly assisted by the National Centres, other link bodies or individuals. Responsibility for its operation would fall on the Institute's Information Officers, working under the Deputy Director.

The secondary documentation (abstracts, etc.) prepared by various international and national bodies may be of considerable value to the Institute. The Institute is in a unique position to make a world-wide collection of such secondary documentation and to hold it on record for reference. Furthermore, the receipt of the secondary documentation would greatly assist in the selection of the primary material for processing.

Of course, all such documentation will be held in the library, which will also acquire reference and background material for the officers of the Institute; official papers and records; abstracts, bibliographies and other secondary documentation.

(*c*) *Dissemination*

This is undoubtedly a crucial problem on which the success of the Institute will depend. The ultimate users of the information are the practitioners—the architect, engineer, builder, planner—directly responsible for housing, building and planning. Whilst the Digests will be in readily-usable form and in four main languages, there is still the problem of getting them into the hands of the user. The standing distribution of UN documents—over seven thousand copies—goes mainly to government departments. Sales can assist availability, but would usually be in the form of an overall subscription.

The practitioners are numbered in hundreds and thousands in every country and it would not be practicable for the Institute to be in direct contact with them individually. Also, in many cases translation into a local language would be necessary.

It is therefore foreseen that channels of dissemination downwards are essential. The most important of the agencies would be at the national level, *viz.* a housing, building and planning documentation centre in every country, nominated by the national government and responsible for onward transmission and further dissemination of the information within its national borders. Contributions to the network would also be made by (*a*) Regional Economic Commissions; (*b*) international bodies of governmental or non-governmental constitution; (*c*) other specialized documentation centres.

(*d*) *Publication*

The Group considered that it would not be practical to use letter-press printing in view of the use of four languages and the necessary speed of action. It recommends the use of offset printing. Mr Polidar made an extensive study of the latest methods and the equipment required for an output of one million pages per month.

(*e*) *Information Service*

A most important service of the Institute would be replying to inquiries on specific subjects. Normally these inquiries would be received from National Centres, after they have satisfied themselves that the questions cannot be answered from existing sources within their country. It would not generally be possible to admit inquiries directly from individuals, though these might be directed to an appropriate centre.

Inquiries would ordinarily be answered from the resources of the Institute, though the answers may frequently be supplemented by referring the inquirer to an appropriate centre for fuller information.

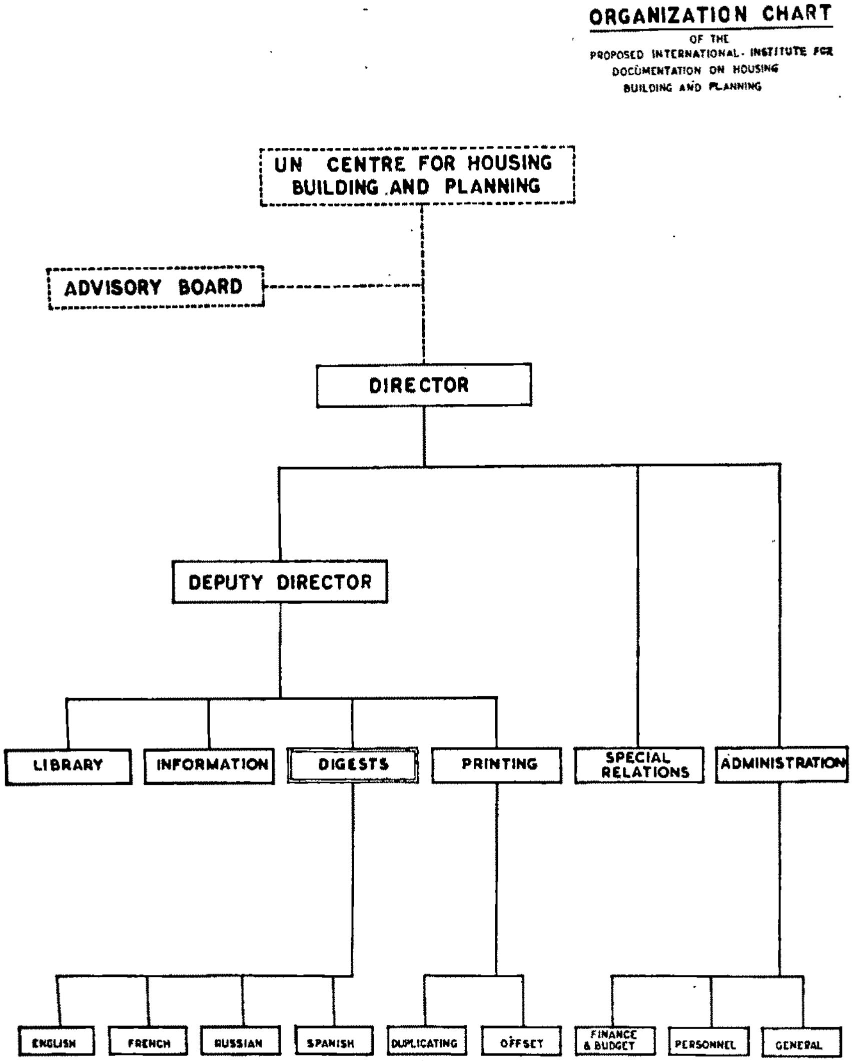
6 ORGANIZATION AND STAFF

At this stage it is convenient to introduce the Organization Chart (see page 167). Annex V of the Expert Group's report gives detailed job descriptions, qualifications and recommended grading for each post. The functions of each section are given in the main body of the Report; here I shall give only a brief indication.

(*a*) *Library.* Procurement, indexing and classification. The Library plays a fundamental role in the Institute. Three professionals, seven clerical.

(*b*) *Information Section.* Three professional officers with the dual role of selecting material for processing i.e. *Digest*, annotated reference, indexing, etc., and also collating the replies to external inquiries.

(*c*) *Digests Section.* This consists of four language groups, each having a Professional Documentalist, four translators, a stenographer and typist, except for the English language Group which has two professional documentalists and three translators. The documentalist will normally be responsible for the preparation of the original digest and the translators responsible for translating



into their own language the digests prepared by the other Groups.

Each Group will supply the material for its own language edition in 'fair copy' form for the photo-printing section, thus eliminating proof-reading. The staff is thus twenty professional and eight clerical.

(*d*) *Printing Section.* This will have one professional and twenty-eight other staff.

(*e*) *Special Relations.* This is an important section of three professional officers working to the Director. Their function is liaison, particularly with the National Centres. They will be appointed on a Regional basis and their job will involve extensive travelling. Their duties are multifarious, but part of their work will be to advise on the effective dissemination downwards of information processed by the Institute.

(*f*) *Administration.* This is self-explanatory. It involves four professional and thirty-four clerical and others (principally local).

The total proposed staff is 119 (thirty-six professional, forty-three clerical or specially skilled and forty others, typists, messengers, cleaners, etc.).

7 MISCELLANEOUS MATTERS

(*a*) *General.* In the foregoing I have given a picture of the main structure of the Institute as seen by the Expert Group. But time has not permitted me to include a large number of secondary functions and considerations which will naturally pertain to the Institute as a result of its existence and the closer bilateral co-operation between the network of links of which the Institute will be the nucleus and the catalyst.

These include such things as the systematic build-up of the Library, directories, glossaries, methodology, classification, standardization of definitions, computer applications, detection of gaps in knowledge, raw material for surveys and statistical studies and the employment of experts and consultants on specific matters.

The Group specifically excludes certain activities from the Institute's field. These include: (*a*) Full-length translations; (*b*) Critical appraisals of progress in particular fields; (*c*) Preparation of manuals or text-books; (*d*) The role of consultant, except in the matter of documentation.

(*b*) *National Centres.* References have been made above to 'National Centres', their essential role in disseminating technical information within their countries and their assistance in selection and provision of material to the Institute.

It must be emphasized that it is not proposed that such Centres should be stereotyped or even formally established. They will vary very considerably from country to country, in accordance with the resources and the requirements of the country.

The definition of National Centre adopted by the Group is:

> 'A documentation centre for housing, building and planning nominated by the Government as the sole centre in that country as the national link with the Institute. A national centre may be a government or non-governmental organization or even a person, until an organization can be nominated.'

(*c*) *Computers.* It is important that the Institute should have modern equipment and employ up-to-date methods. The Group does not, however, foresee the application of a computer in connexion with its work within the first years; this conclusion is based partly on the comparatively small volume of output by the Institute and partly on the fact that computer techniques have not yet been fully worked out to assist its particular functions. Should developments require the pilot study of the use of a computer, it is possible to buy computer time.

(*d*) *Advisory Board.* The Group recommends the appointment of an Advisory Board of eight under the Chairmanship of the Director of the UN Centre for Housing, Building and Planning in New York.

(*e*) *Location.* The decision to locate the Institute in New Delhi had already been taken by ECOSOC. The Indian Government has offered generous support in respect of contributions towards staff and accommodation. The Expert Group confirms that New Delhi is a satisfactory location for the Institute.

(*f*) *Finance.* The cost of the Institute on the basis outlined works out at US $202,700 non-recurring and an annual budget of US $1,053,800 for the first three years; which is of the same order as the 'guestimate' of the Secretary-General in the Paper submitted to ECOSOC.

It is understood, however, that the Institute cannot be a charge on the regular budget of UN. It will have to depend on voluntary support from member countries and any contributions which may be available from various funds.

8 PHASES OF IMPLEMENTATION

The Group foresees the establishment of the Institute as taking place in three stages, *viz.*

Phase I. Preparatory, including establishing contacts and obtaining financial contributions. Contributions of personnel or equipment might also be entertained. This phase may well be based on Geneva and be undertaken by the Director of the Institute, a documentalist and the three Special Relations Officers, with a small clerical staff. A period of six months may suffice.

Phase II. The growth phase, covering recruitment of staff, procurement and installation of equipment, arranging the continued supply of literature. This phase must be in New Delhi. It may take up to nine months, but would not preclude the issue of preliminary, pilot and interim working documents.

Phase III. Operational.

9 FURTHER DEVELOPMENTS

The above has presented in outline the gist of the *Report* of the Expert Group.

The *Report* was considered in October 1967 by the UN Committee for Housing, Building and Planning, meeting in Geneva. The Committee approved a Draft Resolution for ECOSOC to consider at its meeting in May 1968.

The Draft Resolution, couched in customary terms, commends the Expert Group for the quality of the *Report*; requests the Secretary-General to approach Member States for funds to begin the work of implementation in order to set up the Institute in New Delhi; when funds are available, to establish an Advisory Board, the first task of which would be to define the functions of a working party charged with the responsibility for the detailed technical aspects of the preparatory phase.

Then paragraph 3 anticipates the conclusions of the Advisory Board and reads as follows:

> 'To establish, as soon as adequate funds are available, and for a period of two to three years, a working party in Geneva consisting primarily of documentation experts selected, as far as possible, on the basis of regional representation, whose tasks would be (*a*) to maintain, preferably by written papers, contact with the Advisory Board; (*b*) to establish a network of documentary

exchange between national centres, regional centres and other international centres with the Institute; (*c*) to guide and assist in the setting up of a single national centre for documentation within each participating Member State; (*d*) to arrange for the basic documentation of the more important literature pertaining to Housing, Building and Planning to be undertaken in the various centres and for its transmission unified as to methodology and terminology to the Institute, thus enabling it to play its part as a world clearing house of knowledge.'

It will be noted that paragraph 3 is in no way supported by the advice of the Expert Group. The small *ad hoc* group which drafted the Draft Resolution obviously did not contain a documentalist. Item (*c*) would not be supported by any international documentalist in his senses. Item (*d*) is extremely unlikely to operate in practice. While the idea of a Working Party spending two to three years promoting the setting up *in vacuo* of national centres without the stimulus or material flowing from the central Institute, strikes one as a prize example of tackling the job backside foremost.

It is most devoutly to be hoped that ECOSOC will have the sense to delete paragraph 3 from the Draft Resolution and put its trust in the discretion of the Secretary-General acting on the advice of the Advisory Board.

PRODUCT ANALYSIS BY CO-ORDINATE INDEX

G. H. HUTTON
Hutton & Rostron, Architects

Paper presented at a meeting of the Co-ordinate Indexing Group, Monday 30th October 1967

As architects with a specialized practice giving advice to manufacturers and others on product development and performance specification, we find the handling and interpretation of information forms an important part of our work. In 1964 we were commissioned to investigate the building industry in Britain with regard to demand, resources and techniques. Among other things, this task entailed analysing 330 proprietary building systems. To study and compare products in this advanced technical area was obviously going to be a far more complicated process than a straightforward comparison of single materials or appliances, and a suitable method for doing it had to be found. The following is an account of the steps that led us to co-ordinate indexing and our application of the system.

In the days when building meant using local materials and inherited skills, every job was a 'one-off' exercise with little clear division between design and execution. Then manufacturing techniques began to make it possible for materials to be supplied in bulk and for parts of the structure to be made off the site and delivered ready for fixing. Although some traditional site operations are still called for, these are tending to diminish in number. Components for site assembly of particular building types have been evolved and also systems of interchangeable components for constructing any number of buildings for different purposes. Finally, it is now possible to obtain prefabricated living or working spaces which can be fitted together to form a building or part of a building. The architect must design with a knowledge of all the ways currently open to him for achieving the result he wants, but in an age of rapid development must not be expected to rely on his memory for his information.

Design is largely a series of choices. Each selection of a material or component is made on the available criteria from the known field of products. The evolution of criteria and comparison and selection are fundamental design activities.

As products become more complex the designer's freedom to determine the exact characteristics of his design is limited. Instead he must select from the available products those nearest to his purpose. It is important that no suitable product should be overlooked, as this is an artificial limitation of choice. The criteria for choice must be carefully selected and products directly compared in these terms.

Few architects or designers would have difficulty in compiling a list of manufacturers of metal window frames. The *London Classified Telephone Directory,* for example, lists forty-eight manufacturers, the *AJ's Product File* thirty-seven and *Building's Guide to Materials and Suppliers* twenty-five. In addition, the Metal Window Manufacturers' Association and the Building Centre are able to supply general lists.

Suppose, however, that a designer required to know which manufacturers supplied a metal window of the following description:

TYPE:	double hung vertical sliding sash
SIZE:	5 ft. 8 in. × 4 ft. 0 in. wide
MATERIAL:	aluminium alloy HE9
FINISH:	satin anodised to grade AA35 to BS1615 : 1961 with strippable lacquer protection
OPERATION:	gear operated with plastic-coated operating handle
GLAZING:	suitable for sealed double glazing units

This description is neither exhaustive nor unusual in its requirements and yet none of the publications or authorities mentioned, no classification in common use and no catalogue distribution service could readily supply the names (if any) of manufacturers producing such a window.

This example illustrates the difficulty facing designers in selecting a product to satisfy known requirements. The information which is readily available is often so general as to be almost useless, while the designer's greatest need—for specific information—is frequently unsatisfied because of the time and effort necessary to find this information.

This may result in the specification of unsuitable or partly suitable products, since the only way to find the information needed is to search systematically through available catalogues. The searcher will tend to use the first product which approximates to the required performance, rather than continue the search through all catalogues to obtain acceptable alternatives. His choice is therefore limited not by the availability of products, but by the arrangement of information.

Most of the product information available to designers is organized around a *name*—the name of a manufacturer, a product, an element, a material and so on. It is usual, however, for the name to be the outcome of an inquiry rather than the starting point. The designer starts with a set of requirements and needs to *know* the name of the manufacturers, product, or material, which satisfies them. Because of the way in which information is organized in most libraries, the problem is similar to trying to find the name of a subscriber in a telephone directory when only his telephone number is known.

The enormous difference between the form in which product information is available and the form in which it is required by designers became apparent to us early in 1965 when we began to survey and analyse all proprietary building systems in the United Kingdom. At that time, the available sources of information on building systems used conventional name-based retrieval methods and consequently suffered from the limitations described. Their most severe limitation was that they were of no possible use to a designer or specifier wishing to satisfy a precise set of requirements.

We required a method of analysis which would satisfy the following needs:

1 Retrieval of product data on a specific building system or systems irrespective of whether requirements are:
   (*a*) manufacturer's name
   (*b*) name of system
   (*c*) description of system

1. CHARACTERISTICS (continued)

1.5 VERTICAL STRUCTURE:

Internal: Cross wall ---------- 109 proprietary elements
Spine wall ---------- 110
Diaphragm wall ---------- (111)
Column grid ---------- 112
Tower structure ---------- 113
Perimeter: Perimeter cross wall ---------- 114
Other solid or pierced wall ---- 115
Prefabricated structural framed wall ---------- (116)
Column grid ---------- 117 10ft and over
Multi-strut column grid ---------- 118 less than 10ft

1.6 FLOOR STRUCTURE:

Type: homogeneous slab ---------- 119 proprietary elements
joist and skin ---------- (120)
other ---------- 121
Span: 1-way ---------- (122)
2-way ---------- 123

1.7 ROOF STRUCTURE:

Type: homogeneous slab ---------- 124 proprietary elements
joist and skin ---------- 125
truss and purlin ---------- (126)
other ---------- 127
Span: 1-way ---------- (128)
2-way ---------- 129

1.8 FIRE PROTECTION PROVIDED:

Vertical structure: integral ---------- (130)
heavy (concrete, brick) 131
light (casings, spray) 132
Floor structure: integral ---------- 133
heavy (concrete) ---------- 134
light (casings, spray) --- 135
ceiling ---------- (136)

1.9 VERTICAL ENVELOPE:

Large units attached direct to structure without framing or rails ---------- 137 NB rails, framing or backing are CARCASS (Feature 319)
Large panels or sheets fixed to secondary frame, rails or backing ---------- 138
Small units (shingles, boards, tiles) fixed to secondary frame or backing ---------- (139)
Assembly of self-supporting small units (bricks, blocks) ---------- 140
Integral part of structure ---------- (141)

1.10 ROOF:

Pitched: 5 to 15 deg ---------- 142 18 deg = 1:3
more than 15 deg ---------- (143) 15 deg = 1:3¾
Flat: less than 5 deg ---------- 144 7 deg = 1:8
Curved ---------- 145 5 deg = 1:11½

1.11 SITE PRODUCTIVITY (proprietary elements):

10ft^2/man day or less ---------- (146) 1 year = 245 days
11-50 ---------- (147) = 2200 hours
51-100 ---------- (148) 1 month = 20 days
101-150 ---------- (149) = 184 hours
151-200 ---------- 150 1 week = 5 days
201-350 ---------- 151 = 46 hours
351-450 ---------- 152 1 day = 9 hours
over 450 ---------- 153

FIG. I. FEATURE LIST

2 Statistical analysis of all available building systems based upon:
  (*a*) availability
  (*b*) characteristics and performance
  (*c*) completeness
  (*d*) techniques used

It was soon apparent that a classification of any sort would not provide this flexibility. What was needed was an *index* of all relevant characteristics and a method of comparing or combining them. This is provided by a co-ordinate index on body-punched feature cards, together with alphabetical and numerical indexes. The analysis of each building system was performed by means of a feature list.

Each of the components of the index is described below.

FEATURE LIST

The feature list is used to ensure that all building systems are analysed in a uniform manner. It is a numbered list of 558 'features' or characteristics of building systems arranged on twelve A4 pages. A typical page is shown in Fig. 1.

Features are grouped together under the following sixty-one criteria:

0 **Availability**
  0.1 proprietary nature
  0.2 sponsor
  0.3 extent of service
  0.4 availability in UK
  0.5 system no longer in production
  0.6 nationality
  0.7 export from UK
  0.8 location of factory
  0.9 stage of development
  0.10 documentation
  0.11 sales
  0.12 production capacity

1 **Characteristics**
  1.1 building use
  1.2 number of storeys
  1.3 type plans
  1.4 type dwellings
  1.5 vertical structure
  1.6 floor structure
  1.7 roof structure
  1.8 fire protection
  1.9 vertical envelope
  1.10 roof pitch
  1.11, 1.12 site productivity
  1.13, 1.14 cost

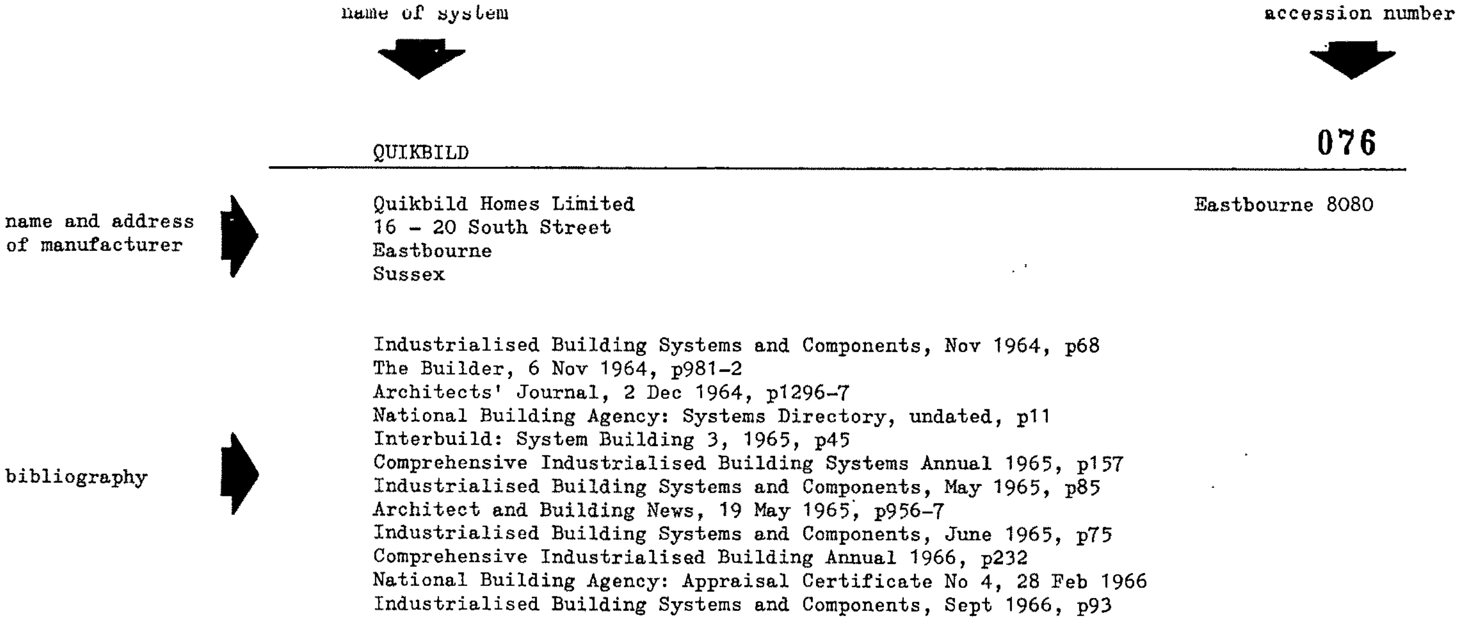
2 **Performance**
- 2.1 maximum imposed floor loading
- 2.2 analysis of accommodation
- 2.3 thermal capacity
- 2.4 thermal insulation
- 2.5 sound insulation
- 2.6 approximate design life
- 2.7 approval for local authority and/or mortgage loan
- 2.8 maintenance grading
- 2.9 NBA appraisal

3 **Dimensional Basis**
- 3.1 vertical
- 3.2 horizontal
- 3.3 planning grid
- 3.4, 3.5 frame span
- 3.6 ceiling height
- 3.7 floor depth

4 **Elements Comprising Product**
- 4.1 substructure
- 4.2 structure
- 4.3 staircase
- 4.4 vertical envelope
- 4.5 horizontal envelope
- 4.6 internal division
- 4.7 installation
- 4.8 finishes
- 4.9 fixtures and equipment
- 4.10 elemental completeness

5 **Erection**
- 5.1 erection techniques
- 5.2 installation
- 5.3 skill required
- 5.4, 5.5 speed of erection

6 **Elemental Analysis**
- 6.1 substructure
- 6.2 structure
- 6.3 wall and roof insulation
- 6.4 cladding material
- 6.5 roof finish
- 6.6 installation
- 6.7 separating walls
- 6.8 upper floor performance


name of system
accession number
name and address of manufacturer
bibliography

QUIKBILD 076

Quikbild Homes Limited Eastbourne 8080
16 - 20 South Street
Eastbourne
Sussex

Industrialised Building Systems and Components, Nov 1964, p68
The Builder, 6 Nov 1964, p981-2
Architects' Journal, 2 Dec 1964, p1296-7
National Building Agency: Systems Directory, undated, p11
Interbuild: System Building 3, 1965, p45
Comprehensive Industrialised Building Systems Annual 1965, p157
Industrialised Building Systems and Components, May 1965, p85
Architect and Building News, 19 May 1965, p956-7
Industrialised Building Systems and Components, June 1965, p75
Comprehensive Industrialised Building Annual 1966, p232
National Building Agency: Appraisal Certificate No 4, 28 Feb 1966
Industrialised Building Systems and Components, Sept 1966, p93

FIG. 2. NAME REGISTER: CARD INDEX

Precast Associated Constructors Limited	197
Pre Fabricated Bathrooms Limited	260
PREFORM	252
Procol Limited	174
PROGRAM-H	300
PROMETO	285
Purpose Built Limited	200
PUUTALO	054
QUIKBILD	076
Quikbild Homes Limited	076
RAB	015
RPM Summer Chalet Developments	157
RTE	181
Rainham Timber Engineering Company Limited: RTE	181
NORAN	314
RATRA	158
RATRAD	203
Record Building Units Limited	121
Redpath Brown and Company Limited: ARBIGRILL	315
Reema Construction Limited: REEMA HOUSING	077
REEMA CONCLAD	078
RESIFORM	059
Rigid Frame Construction Limited	113

FIG. 3. NAME REGISTER: ALPHABETICAL LIST

The analysis is carried out completing a feature list for each building system by circling the appropriate features as shown in Fig. 1.

Some questions require only a straight yes or no; some are quantifiable. The characteristics which can be quantified are either roughly graded (e.g. high, low, negligible) with the limits indicated, or given as bands of values. The upper and lower limits of the bands and the increments used are obviously important. A measure of technical knowledge was needed for filling in the answers but the amount of discretion to be exercised was kept to a minimum. The feature list has been revised twice in the light of experience and the third edition should be quite clear cut.

SYSTEM FILE

Data on each building system is contained in a *system file.* Typical contents would include:

completed feature list
correspondence with manufacturer
manufacturer's trade information and drawings
cuttings and extracts from technical and financial press

Each building system (or each version if more than one) is given an *accession number* which is simply a sequential number allocated to the system on its first entry. The accession number identifies the system throughout the index and is printed on all documents relating to that system.

NAME REGISTER

The name register is kept in two forms. The first is a card index with one 8 in. × 5 in. card for each system (Fig. 2). Each card contains the name of the system, name, address and telephone number of manufacturer, accession number and bibliography of references to the system. The cards are kept in alphabetical order of manufacturers.

The second form of name register is an alphabetical A4 list of system name and manufacturer's name and accession number (Fig. 3).

ACCESSION REGISTER

The accession register is a list of accession numbers arranged in numerical order with name of manufacturer and system (Fig. 4).

065	Chaston Standard Factories
066	Trent Concrete Limited
067	Yorkshire Homes
068	Banbury Industrial Buildings
069	Butler Buildings
070	Marley C-Plan
071	Marley M-Plan
072	Marley Home Extension
073	Marley Garage
074	Marley Portable
075	Marley Mini Buildings
076	Quikbild
077	Reema Housing
078	Reema Conclad
079	Scottish Special Housing
080	Sanders and Forster Steel Framed
081	Housing Development and Construction
082	Johnson
083	Sutcliffe
084	Gilbert-Ash Intergrid

FIG. 4. ACCESSION REGISTER

The feature list, system file, name register and accession register used together enable the characteristics of the system to be assessed and identified, and full data on all systems to be retrieved on the manufacturer's or system name. The remaining component is the co-ordinate index which allows systems to be retrieved on the basis of their characteristics.

CO-ORDINATE INDEX

The co-ordinate index consists of 558 feature cards—one for each item of the feature list and numbered to correspond.

The feature cards of the co-ordinate index enable statistical analyses to be made and product data to be retrieved on a system description only.

A statistical analysis can be made by counting the number of holes on any feature card and relating this number to the total number of systems analysed. Examples of such results are: 11 per cent of all systems manufactured in the UK are exported, 54 per cent of all systems are housing systems and 56 per cent of housing systems include a party wall.

The most important function of the index is, however, to find which system or systems satisfy a chosen set of criteria. To do this a performance specification of the desirable system is compiled, using the feature list. The required features are arranged in descending order of priority and the punched feature cards stacked together in the same order. Any light showing through holes in the stack will, of course, indicate the systems which possess the required features. In practice, however, requirements are usually too severe to be met by available characteristics and it is unlikely that any systems will possess all the required features. The features of less importance are then progressively discarded from the stack of cards until one or more systems are identified.

It has been found in practice that if more than about twelve features are used it is unusual for any system to be selected. Nevertheless, even if only twelve features are used, it is possible to retrieve each system in 1,742,004,536,175 different ways.

Because a single feature card allows some light to pass through when not punched, it is possible to separate those systems which are near misses, that is, systems which possess all the required characteristics except one. The index also allows priorities to be changed or different features to be inserted with ease. In addition, some characteristics not listed can be deduced from combination of characteristics assessed.

These techniques make it possible to prepare a short list of possible systems which satisfy the desired requirements. Final selection is then made from the full data in the system files and directly from the manufacturers.

The whole field is considered in the investigation and a preliminary selection made on a sound basis before proceeding with further work or wasting the time of manufacturers with premature inquiries.

In order to keep the information up to date, the system manufacturers are circulated at regular intervals and an eye is kept on the technical press for new systems. Major revisions are treated as new systems and a filter card is punched to cancel out-of-date information. A complete revision is in progress based on the third edition of the feature list.

We were impressed by the speed and accuracy of the co-ordinate index system as a tool for manipulating information. Particular advantages for us are:

1. a rational relationship can be established between requirements and available products.
2. flexibility of choice is retained before criteria are finally determined.
3. statistical and other information is available as a by-product.

THE CONSTRUCTION OF A THESAURUS

R. M. ROSTRON
Hutton & Rostron, Architects

Paper presented at a meeting of the Co-ordinate Indexing Group, Monday 30th October 1967

OUR first attempt at co-ordinate indexing was the analysis of proprietary building systems, but the results were so encouraging that we decided to apply the method to the much wider problems of technical literature. The decision to use co-ordinate indexing for this literature was not quite so clear-cut, as general and special classifications for building already exist and are being used, with varying degrees of success, for retrieving technical information. We have had some experience in the use of these classifications and have rejected them for our purpose for a number of reasons:

1 Each piece of information is unique and any attempt to categorize it by fitting it into a limited number of classes must make retrieval less precise.

2 Each piece of information consists of a number of concepts but, as with building systems, which of these are important to the user can only be decided at the time of retrieval, not at the time of indexing.

3 We needed to store our information in an order suitable for browsing (for example keeping all textbooks together) and for other purposes such as storing journals in bound volumes, *British Standards* and *BRS Digests* in numerical order, all Government publications together and so on. We therefore required an *index of addresses* rather than a classification.

4 Both the major classifications for building lag far behind technical advance and current thinking in building.

We therefore decided to use keywords and a co-ordinate index and our first job was to find a suitable keyword list.

We found those prepared specially for building were too sketchy to cover the field and too undisciplined. Words were added at random: for instance, *disabled* and *handicapped* were both listed, causing confusion. There were also undefined terms, like *architecture,* that would be of very little use.

On the other hand, a generalized list of terms like the *EJC thesaurus of engineering terms,* though excellent, covered too wide a field for our purposes, yet omitted many concepts important for building.

So we decided to prepare our own keyword list and, probably like others who have attempted it before us, we thought it would be an interesting and comparatively easy job; like others, we were soon disillusioned.

Examination of the shortcomings of other lists gave us some aims desirable for our own:

1. To make possible indexing by staff without specialized knowledge.
2. To identify all synonyms and homonyms before indexing.
3. To evolve a disciplined method of updating the keyword list.
4. To find a flexible method of dealing with proper names. This last is important in building, since proprietary names occur at every stage. Often these are synonyms for some material (e.g. Perspex = methylmethacrylate) and can be cross-referenced, but often they are not (e.g. names of countries, authors), and must be entered separately.

These principles gave birth to the idea of a comprehensive word list to be used as an index to keywords and keyword combinations.

We set about preparing the list by the following process. We are not librarians and do not put forward our method of compiling the list as the best or the only way; it is the method we evolved through trial and error to suit our purpose.

1. Words were collected from a number of carefully selected sources. These were classifications and dictionaries chosen to give a uniform spread over materials, techniques and performance and included, for example, the *SfB classification* and the *CIB master list of properties for building materials and products.*
2. The words were consolidated into one alphabetical list after identifying all true synonyms and homonyms. A typical extract from this list is:

   pier (column)
   (marine)
   pile (of carpet)
   (heap)
   (foundation)
   pile driver
   pipe
   pisé
   pit
   pitch (cover with stones)
   (distance, e.g. thread)
   (games)
   (material)
   (slope)
   (sound)
   pitch pine
   etc.
3. The next step was the most difficult and resulted in a number of false starts. At first we tried to allocate keywords to each word on the alphabetical list by a purely intellectual process, but this proved an ineffective method of generating keywords.

   We needed to find which basic concepts were represented by each word and to rearrange these words so that those with concepts in common were brought together. To do this, we went through the alphabetical list, entering words with concepts in common on numbered cards. A typical numbered card contained the following words with a common concept:

Card No 14

adhesive
adhere
glue (adhesive)
gluing
bond (join)
cement (adhesive)
gum
key (bond)
keyed
bond (gluing)
glue (process)

4 The cards were identified by numbers on the alphabetical word list and new words added only as necessary. If the balance of words was correct, further words could be added later without introducing new concepts. The list now appeared something like this:

permeability	233		
permit	11		
personnel	38	person	38
perspective	134		
Perspex	10		
pest control	99		
petrol	199	phenol	290
petroleum	199		
phenolic resin	10	phosphor bronze	141
photography	135	phosphating	132
physics	188	photogravure	135
physiology	197		
picture	53	pickling	132

etc.

Some words are not made up of a single concept, but contain elements of several. It was necessary in these cases to cross-reference. For example card 78, containing words with the concept of a railing or barrier (*balustrade, handrail,* etc.), overlaps with card 138, containing words with the concept of a limit (*boundary, extent, maximum, minimum*), so each of these cards carries a 'see also' reference to the other. In some cases, a card may carry a number of such references.

Sometimes the concept of a single card has multiple connotations; for example, that listing *cavity, hole, pit, mine,* also contains the products of the excavations *spoil, excavated earth.*

The collecting together of words with concepts in common was continued throughout the alphabetical word list. At this stage concepts were not identified.

The result was a numbered alphabetical word list relating to 304 cards.

5 The next step was to identify the concepts by allocating a label to each card. Many of the labels denoted single concepts (e.g. *access, defence*) others multiple, overlapping concepts (e.g. *task* + *furniture* for such words as *bench, worktop, counter, desk*; and *resting* + *furniture* for such words as *bed, seat, chair*).

6 A consolidated list of all concepts could now be prepared. They were not yet keywords, but basic concepts that needed identifying with either one label or a combination of labels as follows:

9 sound
10 thermoplast + thermoset
11 law
12 skill
13 mix
14 adhere + fix
15 administration
etc.

It was necessary at this stage for the words to have some literal associations so that we could manipulate them easily, but once the final label was established this would no longer be necessary.

7 It was now possible to compile a provisional keyword list based on **6.** This was divided into:

1 abstract concepts
2 processes and activities
3 objects
4 substances

From now on the keywords were to be considered only as labels or codes for particular concepts, without inherent meaning: they could as easily have been numbers, except that letters are more memorable. To emphasize their lack of inherent meaning it was decided to use as keywords only the first five letters of the label, e.g.:

1 *Abstract concepts*			2 *Processes and activities*		
ACCES	S	5	ADMIN	ISTRATION	15, 43
ADVIC	E	18	ALIGN	MENT	26
ANALO	GUE	35	APPOR	TION	28, 100
ANCIL	LARY	6	ARRAN	GEMENT	51
AUTO		68	ASSEM	BLY	61
BOTAN	Y	137	BIRTH		268
etc.			etc.		

8 During this time, we had been considering a method for indexing proper names and decided to use alphabetical polygraphs in random order, using the letters A to Z as 26 additional keywords.

Lists of digraphs and trigraphs are commercially available, but trigraphs give only 2,600 combinations which seemed insufficient for the number of proper names we may need to handle.

Tetragraphs (14,950 combinations) would have given us ample margin, but no published version was available.

We therefore decided to write our own computer program and an extract from the output of this program is illustrated.

9 We were now in a position to allocate firm keywords to our concept cards, e.g.

ABRAD

abrade + PROCE
abrasion
abrasive + MATTE

```
10951 GPWZ  10952 GPXY  1095  GPXZ  10954 GPYZ  10955 GQRS  10956 GQRT  10957 GQRU  10958 GQRV  10959 GQRW  10960 GQRX
10961 GQRY  10962 GQRZ  10963 GQST  10964 GQSU  10965 GQSV  10966 GQSW  10967 GQSX  10968 GQSY  10969 GQSZ  10970 GQTU
10971 GQTV  10972 GQTW  10973 GQTX  10974 GQTY  10975 GQTZ  10976 GQUV  10977 GQUW  10978 GQUX  10979 GQUY  10980 GQUZ
10981 GQVW  10982 GQVX  10983 GQVY  10984 GQVZ  10985 GQWX  10986 GQWY  10987 GQWZ  10988 GQXY  10989 GQXZ  10990 GQYZ
10991 GRST  10992 GRSU  10993 GRSV  10994 GRSW  10995 GRSX  10996 GRSY  10997 GRSZ  10998 GRTU  10999 GRTV  11000 GRTW

11001 GRTX  11002 GRTY  11003 GRTZ  11004 GRUV  11005 GRUW  11006 GRUX  11007 GRUY  11008 GRUZ  11009 GRVW  11010 GRVX
11011 GRVY  11012 GRVZ  11013 GRWX  11014 GRWY  11015 GRWZ  11016 GRXY  11017 GRXZ  11018 GRYZ  11019 GSTU  11020 GSTV
11021 GSTW  11022 GSTX  11023 GSTY  11024 GSTZ  11025 GSUV  11026 GSUW  11027 GSUX  11028 GSUY  11029 GSUZ  11030 GSVW
11031 GSVX  11032 GSVY  11033 GSVZ  11034 GSWX  11035 GSWY  11036 GSWZ  11037 GSXY  11038 GSXZ  11039 GSYZ  11040 GTUV
11041 GTUW  11042 GTUX  11043 GTUY  11044 GTUZ  11045 GTVW  11046 GTVX  11047 GTVY  11048 GTVZ  11049 GTWX  11050 GTWY

11051 GTWZ  11052 GTXY  11053 GTXZ  11054 GTYZ  11055 GUVW  11056 GUVX  11057 GUVY  11058 GUVZ  11059 GUWX  11060 GUWY
11061 GUWZ  11062 GUXY  11063 GUXZ  11064 GUYZ  11065 GVWX  11066 GVWY  11067 GVWZ  11068 GVXY  11069 GVXZ  11070 GVYZ
11071 GWXY  11072 GWXZ  11073 GWYZ  11074 GXYZ  11075 HIJK  11076 HIJL  11077 HIJM  11078 HIJN  11079 HIJO  11080 HIJP
11081 HIJQ  11082 HIJR  11083 HIJS  11084 HIJT  11085 HIJU  11086 HIJV  11087 HIJW  11088 HIJX  11089 HIJY  11090 HIJZ
11091 HIKL  11092 HIKM  11093 HIKN  11094 HIKO  11095 HIKP  11096 HIKQ  11097 HIKR  11098 HIKS  11099 HIKT  11100 HIKU

11101 HIKV  11102 HIKW  11103 HIKX  11104 HIKY  11105 HIKZ  11106 HILM  11107 HILN  11108 HILO  11109 HILP  11110 HILQ
11111 HILR  11112 HILS  11113 HILT  11114 HILU  11115 HILV  11116 HILW  11117 HILX  11118 HILY  11119 HILZ  11120 HIMN
11121 HIMO  11122 HIMP  11123 HIMQ  11124 HIMR  11125 HIMS  11126 HIMT  11127 HIMU  11128 HIMV  11129 HIMW  11130 HIMX
11131 HIMY  11132 HIMZ  11133 HINO  11134 HINP  11135 HINQ  11136 HINR  11137 HINS  11138 HINT  11139 HINU  11140 HINV
11141 HINW  11142 HINX  11143 HINY  11144 HINZ  11145 HIOP  11146 HIOQ  11147 HIOR  11148 HIOS  11149 HIOT  11150 HIOU

11151 HIOV  11152 HIOW  11153 HIOX  11154 HIOY  11155 HIOZ  11156 HIPQ  11157 HIPR  11158 HIPS  11159 HIPT  11160 HIPU
11161 HIPV  11162 HIPW  11163 HIPX  11164 HIPY  11165 HIPZ  11166 HIQR  11167 HIQS  11168 HIQT  11169 HIQU  11170 HIQV
11171 HIQW  11172 HIQX  11173 HIQY  11174 HIQZ  11175 HIRS  11176 HIRT  11177 HIRU  11178 HIRV  11179 HIRW  11180 HIRX
11181 HIRY  11182 HIRZ  11183 HIST  11184 HISU  11185 HISV  11186 HISW  11187 HISX  11188 HISY  11189 HISZ  11190 HITU
11191 HITV  11192 HITW  11193 HITX  11194 HITY  11195 HITZ  11196 HIUV  11197 HIUW  11198 HIUX  11199 HIUY  11200 HIUZ

11201 HIVW  11202 HIVX  11203 HIVY  11204 HIVZ  11205 HIWX  11206 HIWY  11207 HIWZ  11208 HIXY  11209 HIXZ  11210 HIYZ
11211 HJKL  11212 HJKM  11213 HJKN  11214 HJKO  11215 HJKP  11216 HJKQ  11217 HJKR  11218 HJKS  11219 HJKT  11220 HJKU
11221 HJKV  11222 HJKW  11223 HJKX  11224 HJKY  11225 HJKZ  11226 HJLM  11227 HJLN  11228 HJLO  11229 HJLP  11230 HJLQ
11231 HJLR  11232 HJLS  11233 HJLT  11234 HJLU  11235 HJLV  11236 HJLW  11237 HJLX  11238 HJLY  11239 HJLZ  11240 HJMN
11241 HJMO  11242 HJMP  11243 HJMQ  11244 HJMR  11245 HJMS  11246 HJMT  11247 HJMU  11248 HJMV  11249 HJMW  11250 HJMX

11251 HJMY  11252 HJMZ  11253 HJNO  11254 HJNP  11255 HJNQ  11256 HJNR  11257 HJNS  11258 HJNT  11259 HJNU  11260 HJNV
11261 HJNW  11262 HJNX  11263 HJNY  11264 HJNZ  11265 HJOP  11266 HJOQ  11267 HJOR  11268 HJOS  11269 HJOT  11270 HJOU
11271 HJOV  11272 HJOW  11273 HJOX  11274 HJOY  11275 HJOZ  11276 HJPQ  11277 HJPR  11278 HJPS  11279 HJPT  11280 HJPU
11281 HJPV  11282 HJPW  11283 HJPX  11284 HJPY  11285 HJPZ  11286 HJQR  11287 HJQS  11288 HJQT  11289 HJQU  11290 HJQV
11291 HJQW  11292 HJQX  11293 HJQY  11294 HJQZ  11295 HJRS  11296 HJRT  11297 HJRU  11298 HJRV  11299 HJRW  11300 HJRX
```

SOME TETRAGRAPHS GENERATED BY THE PROGRAM

barrel polishing + PROCE + END
etc.

The main keyword ABRAD applies to every entry on the card and supplementary keywords distinguish them where necessary. *Abrasion* being the basic concept does not require a supplementary keyword.

Where (+ PORTA) appears, as in *mortar* (*grinding mill*): ABRAD + PROCE + APPLI (+ PORTA), it means that it is not yet known whether the equipment in question is portable. As soon as it is known, + PORTA is added to the combination and unless this appears all equipment is assumed to be fixed.

We are now in the process of allocating the keywords to the concept cards and the result will be in the form of two documents:

(*a*) A dictionary linking real language words to keywords and keywords combinations, e.g.

abutment (element) = DAM + LOAD + PART
(support) = DAM + LOAD
access = ACCES
accessory = ANCIL + PART
accident = END + FLAW + ( )
account (finance) = ECONO + MEASU + QUANT + TEXT
(report) = ADVIC + TEXT

Where ( ) appears after a combination, it means that something more is required to complete the analysis, e.g.
agency = MEANS + ( ) may require the keyword for *man, chemical,* etc. to be added by the indexer.

(*b*) A list of the keywords and keyword combinations used for the purpose of updating.

The list is in alphabetical order and the combinations are permutated. *For our purposes* the words that are listed opposite one combination are synonymous:

APPLI + HYGIE + MAN + PROCE = basin (sanitary)
bath
bidet
lavatory basin
shower fitting
wash basin

To use the system, the indexer will prepare a list of words in real language to describe the text to be indexed and translate these into keywords by means of the dictionary. This will ensure consistent use of the keywords and consistent treatment of synonyms and homonyms, without the need for special skill or experience. For retrieval, the process operates in reverse. The inquiry is translated into keywords and the punched cards for those keywords are selected. These will give the catalogue references for all the material relevant to the inquiry.

The dictionary and the keyword list will be added to as necessary, but, as this would be a tedious task to carry out manually, both lists will be put on to eight-channel punched tape for computer input and updated by means of an edit programme.

When it is completed, the keyword system is to be tested in the library of the School of Architecture at Queen's University, Belfast.

We shall shortly be preparing testing routines to assess the recall and relevance of the system. When testing is complete, we shall be able to supply a coda to the present report if called upon to do so.

SELECTIONS FROM THE RECENT LITERATURE

ALL ITEMS listed may be borrowed from the Aslib Library, except those marked *, which may be consulted in the Library.

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MEMBERS' ADVERTISEMENTS

Acceptance of advertisements for publication in Proceedings *does not imply Aslib support for or endorsement of the goods or services advertised.*

The charge for advertisements in these columns is 4*d* per word, minimum 5*s*. An additional charge of 6*d* is made for the use of a box number.

AUTHORITATIVE TECHNICAL TRANSLATIONS from French, German, and Dutch into English and from English, French and German into Dutch, specialities electronics, optics, instruments, photography. API Ltd, director K. S. Ankersmit, FIL (French, German, English), 19 Godstone Road, Purley, Surrey. BYWood 3781.

TECHNICAL SWEDISH, DANISH, NORWEGIAN translated by J. T. Craddock, B COM, FIL, Ekard, Ray Park Avenue, Maidenhead, Berks. Maidenhead 24931.

WILFRED E. GOODAY, ARSM, DIC, MIMM, FIL. Member of Translators' Guild, Romanian and French. 161 Rivermead Court, London SW6. RENown 1912.

TECHNICAL TRANSLATIONS from Russian, German and Polish into English. B. Klipstein, B SC(HONS). 1 Glenview Grove, Shipley, Yorkshire. Tel. Shipley 58215.

TECHNICAL AND COMMERCIAL translations from English into Russian. Mrs O. Linsley, 31 Parke Road, Barnes, London SW13. Tel. 01-748 8822.

TRANSLATIONS FROM TURKISH. All subjects. F. P. Scott, 4 Uphill Grove, Mill Hill, London NW7.

TRANSLATIONS: TECHNICAL, SCIENTIFIC, all west-European languages. J. Smuts, B SC (ENGINEERING), FIL, 12 Thorndene Avenue, London N11. 01-360 7723.

TECHNICAL OR COMMERCIAL translations into/from English, German, Dutch and French. A. M. H. Speller, FIL, NGV, 6 Lakeside, West Ealing, London W13. Tel. 01-998 1045.

TECHNICAL TRANSLATIONS. Spanish, French, German. Typescript, camera copy, direct image plates. E. W. Sykes, FIL, 39 West Close, Wembley Park, Middlesex. ARNold 4273.

GERMAN/ENGLISH Translations. Commercial or technical, speciality ceramics, immediate service. Margret Young, FIL, 9 Osborne Road, Enfield. HOWard 4366.

BRITISH subject (of Russian origin) B SC (LONDON) undertakes technical and scientific translations from Russian into English and from English into Russian. Previous translations include standard Russian books on Oceanography, Protozoology and Geology. Box 168, Aslib.

Appointments vacant

ASLIB's Research Department requires a qualified librarian in its survey section, initially to undertake a survey of UK science literature resources and potential users. Applicants should possess initiative, persistence and skill in literature-searching, and the ability to take responsibility for a project without constant supervision, and to analyse and report results. Advanced statistical skill is not needed. The successful candidate will be expected to develop an interest in the work of the whole department, which also includes Mechanization, Operational Research and Consultancy Sections. Starting salary £1,100 to £1,200 p.a. Write, giving full details of qualifications and experience, to the Director, Aslib, 3 Belgrave Square, London SW1.

Wanted

Patents for Invention: Abridgments of Specifications. Group IVa Nos. 800,001–820,000, 820,001–840,000, 860,001–880,000 and 880,001–900,000. Group IVb Nos. 900,001–920,000. Offers to the Patents Section, CIBA (A.R.L.) LTD., Duxford, Cambs.

CENTRAL LIBRARY
UNIVERSITY

ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 April 1968 **Number 4**

ASLIB CALENDAR 1968

March

WED.27.	Engineering Group meeting at Birmingham. (See paragraph below.)
FRI.29.	Scottish Branch annual general meeting and conference at Glasgow.

April

FRI.5 – SUN.7.	Transport/Aeronautical Groups joint conference at Cranfield.
MON.8 – TUE.9.	Course on business information at Birmingham.
TUE.23.	Second Aslib Annual Lecture, by Sir Frank Francis.
THU.25 – SAT.27.	Northern/Midlands Branches joint conference at Scarborough, Northern Branch annual general meeting at Scarborough.

May

WED.1.	Engineering Group annual general meeting.
TUE.14.	Economic Group annual general meeting.
WED.15.	Course on advanced patents: opposition. At Aslib.
THU.23.	Evening meeting at Aslib. An industrial patent agent looks at his work.
TUE.28.	Engineering Group evening meeting.

June

TUE.4.	Economics Group visit to *Financial Times*.
FRI.21 – SUN.23.	Electronics Group conference at Berkhamsted.
THU.27.	Transport Group visit to Cement and Concrete Association.

September

SUN.22 – WED.25.	42nd Aslib Annual Conference at Canterbury.

Aslib Services

All members should have received with their March issue of *Aslib Proceedings* a leaflet entitled *Translations and Translators*, describing Aslib services in this field. This is the first of a series of leaflets describing the various Aslib services. A binder will shortly be available for those who wish to collect them.

Engineering Group

A meeting of the Engineering Group will be held at Aslib on Tuesday 28th May, 6 for 6.30 p.m. Following a discussion of the information problems of librarians and engineers, Mr Lawrence, of Indata Ltd, will describe the Indata Industrial Data Service, including extensions of the basic system, e.g. the small libraries scheme and forthcoming additions. Further details may be obtained from Mr B. R. Styles, Ministry of Public Building and Works, Leatherhead Road, Chessington, Surrey.

Honorary Membership

On Wednesday 13th March 1968 the Council of Aslib conferred honorary membership on Mr A. B. Agard Evans, formerly Chief Librarian of the Ministry of Works. (See *Aslib Proceedings*, vol. 20, no. 3, March 1968, p. 155–6.)

NEW MEMBERS

CORPORATE

Name	*Locality*	*Representative*
Alun Jones, Ward & Partners	London	A. G. Sharp
Becton Dickinson (U.K.) Ltd	Middlesex	A. H. de M. Stevens
Eli Lilly & Co Ltd	Hampshire	J. E. F. Reynolds
Fibras Esso S.A.	Spain	Srta. G. Choliz
Land & Marine Contractors Ltd	Cheshire	S. Cook
Library Design & Engineering Ltd	London	R. L. Beuerley
Lilly Research Centre Ltd	Surrey	Mrs C. A. Owen
Rank Organisation Ltd	London	F. J. Davison
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Letchworth College of Technology	Hertfordshire	F. W. Kellaway
National Academy of Science	USA	Mrs J. A. Werdel
Portland, University of	USA	Rev J. P. Browne
Punjabi University	India	Librarian
Western Ontario, University of	Canada	Dr J. J. Talman

INDIVIDUALS

Hilton, Mrs K. P.	Oxfordshire
Silcock, Mrs S. R.	London
Styles, B. R.	Hampshire

Faceted classification

Faceted classification; a guide to the construction and use of special schemes, by B. C. Vickery, originally published by Aslib in 1960 and now out of print, has been reprinted with a small amount of additional material. For the reprint we are able to reduce the price from 12*s* 6*d* to 6*s*.

Institute of Information Scientists; Conference

The Bi-Annual Conference of the Institute of Information Scientists will be held this year at Sheffield University. Following the opening at a civic dinner on the 23rd July, the programme will include eight sessions, closing at lunchtime on Thursday 25th July. Speakers will describe the application of practical experience and research in the following fields:

Industrial Communications (Development of the Scientific Instrument Research Association Industrial Communications Group).

Chemical Structure Work at Sheffield University—The *Mass Spectrometry Bulletin* and Data Centre at the UK Atomic Weapons Research Establishment.

Computer-based chemical information retrieval at the University of Nottingham—application of linear programming techniques to the formulation and implementation of editorial policy in abstracting services.

The Computer control of large collections at the Ministry of Aviation.

Education and training of information scientists and selection of staff.

Metallurgical industry information.

The programme of the Office for Scientific and Technical Information—the National Reference Library of Science and Invention latest developments.

A computer-based information service in physics, electrotechnology and control at the Institution of Electrical Engineers; and information retrieval at the National Computer Centre.

Seminar on Mechanized UDC Retrieval

Provided that a sufficient number of experienced UDC classifiers in different countries are interested, a seminar on the above subject will be held in Copenhagen from Monday 2nd to Friday 6th September, sponsored by FID/CC and FID/DM and organized by FID/CR. (For further details see *FID News Bulletin,* vol. 18, no. 3, 1968, p. 22.)

Anyone interested should contact FID/CR Secretariat, Danmarks Tekniske Bibliotek, Oster Volgade 10, Copenhagen K, *before the end of April.*

Registry for Software Names

The Special Interest Group on Programming Languages (SIGPLAN) of the US Association for Computing Machinery has established a Registry Subcommittee to maintain a registry for the names of programming languages and major, publicly reported software packages, where inadvertent duplication of names could cause confusion.

The chairman is Mr Arnold O. Sobol, Lockheed-California Co., D/83-13, Building 66, Plant A-1, P.O. Box 551, Burbank, California 91503.

LIST OF SHORT COURSES IN LIBRARIANSHIP AND INFORMATION WORK, 1968

Dates	*Total no. of days*	*Subject*	*Location and cost*	*For whom intended*	*Organization and Collaborators*	*Inquiries to*
Apr. 1–5	5	Document Reproduction	Hatfield College of Technology £10	Office executives, O & M officers sales representatives and those engaged in reprography	Hatfield College of Technology	National Reprographic Centre for Documentation, Hatfield College of Technology, Hatfield, Herts.
Apr. 1–5	5	Indexing	North-Western Polytechnic, London. 4 *gns*	Indexers, trainee indexers, librarians, cataloguers, archivists, computer programmers, others interested	Society of Indexers and North-Western Polytechnic	L. M. Harrod, FLA, School of Librarianship, North-Western Polytechnic, 207–225 Essex Road, London N1 *or* J. M. Shaftesley, Hon. Secretary, Society of Indexers, 33 The Grove, Edgware, Middlesex
Apr. 8–9	2	Business information	Birmingham. 7½ *gns*	Open	Aslib	Education Officer, Aslib
Apr. 9–11	3	Local history and associated studies	Loughborough *ca* £5	Students of local studies	Loughborough Technical College	School of Librarianship, Loughborough Technical College, Radmoor, Loughborough, Leics.
Apr. 18–19	2	Computer-based information retrieval systems	Liverpool	Persons active or interested in information work	College of Commerce, Liverpool	B. Houghton, School of Librarianship, Dept. of Professional Studies, College of Commerce, Tithebarn Street, Liverpool 2

Apr. 18–May 5 (Thursday evenings)	5	Special library administration, Series 2: Library services	Liverpool. £3	Practising librarians and information officers	College of Commerce, Liverpool	F. Gibbins, School of Librarianship, Dept. of Professional Studies, College of Commerce, Tithebarn Street, Liverpool 2
Apr. 22–26	5	Library Techniques for Nurse Tutors	Royal College of Nursing, London 10½ *gns*	Nurse tutors and those concerned with libraries for nurses	Royal College of Nursing and National Council of Nurses of the United Kingdom and North-Western Polytechnic	The Librarian, Royal College of Nursing and National Council of Nurses of the United Kingdom, Henrietta Place, London W1
Apr. 22–26	5	Workshop on Medical Librarianship	Leeds. 10 *gns*	Assistant librarians in medical libraries	Leeds College of Commerce	D. Daintree, Esq., Dept. of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1
May 2–4	3	The role of the computer in the organization and handling of information in libraries	Shap Wells Hotel, Westmorland.	Librarians interested in computerization problems	University of Newcastle upon Tyne, N.W. Branch of LA	A. P. Miller, Dept. of Adult Education, The University, Newcastle upon Tyne NE1 7RU
May 15	1	Advanced patents: Opposition	London. 4 *gns*	Library or information staff	Aslib	Education Officer, Aslib
May 22–23	2	Co-ordinate indexing for information retrieval	The Bell Inn, Aston Clinton, nr. Aylesbury. £21	All who are concerned with information retrieval	J. L. Jolley and Partners Ltd.	J. L. Jolley and Partners Ltd., Westbourne House, Westbourne Street, High Wycombe, Bucks

List of Short Courses in Librarianship and Information Work 1968—*continued*

Dates	*Total no. of days*	*Subject*	*Location and cost*	*For whom intended*	*Organization and Collaborators*	*Inquiries to*
June	3	Mechanization without computers	London 10 *gns*		Aslib	Education Officer, Aslib
*June 10–14	5	Management	Lodge Hill, Pulborough, Sussex	Senior librarians	London and Home Counties Branch of LA	W. S Ashmore, FLA, Borough Librarian, Harrow
June 17–28	10	The literature of the natural and social sciences and its guides	NLL Accommodation cost only	Public library staff	NLL	Dr K. P. Barr, NLL
June 29–July 5	7	General library topics	Newbattle Abbey College, Dalkeith £12 10*s*.	Background course for student librarians and holiday and refresher course for more experienced practising librarians of all ages and from all parts of the world	Scottish Library Association	A. G. D White, Esq., ALA, Hon. Sec., Scottish Library Association Summer School, Blackhall Library Hillhouse Road, Edinburgh 4
July	1	Food legislation	London 4 *gns*	Library staffs in the food industry	Aslib	Education Officer, Aslib
July 16–18	3	The NLL and its collections and services	NLL Accommodation cost only	Library school tutors	NLL	Dr K. P. Barr, NLL
Aug. 1968–Jun. 1969 (½day/week)	20	Elementary Librarianship	Kirkcaldy	New assistants in local libraries	Kirkcaldy Technical College	The Librarian, Kirkcaldy Technical College, Kirkcaldy, Fife

Sept.	1	Foreign language dictionaries	London 3 *gns*		Aslib	Education Officer, Aslib
Sept. 22–27	6	History of Bookbinding (advanced)	Oxford. *ca* £20	Members of staffs of national and university libraries who have attended previous courses on this subject or who are engaged in some research or activity connected with the history of bookbinding	SCONUL	Dr W. S. Mitchell, Librarian, University Library, Newcastle upon Tyne 1
Oct.	2	Information on a shoestring	(Provinces) 7 *gns*	Managerial or other staff with part-time responsibility for information	Aslib	Education Officer, Aslib
Oct.	5	Co-ordinate indexing	London 25 *gns*	Graduates or equivalent, or those with experience of library or information work	Aslib	Education Officer, Aslib
Oct.	4	Junior Introductory	London 10 *gns*	Non-graduates in first year of library or information work	Aslib	Education Officer, Aslib
Oct.	4	Introduction to mechanization	London 15 *gns*		Aslib	Education Officer, Aslib

* tentative

LIST OF SHORT COURSES IN LIBRARIANSHIP AND INFORMATION WORK, 1968—*continued*

Dates	*Total no. of days*	*Subject*	*Location and cost*	*For whom intended*	*Organization and Collaborators*	*Inquiries to*
Oct. 21–25	5	Introduction to Management for librarians	Medway and Maidstone College of Technology, Horsted, Chatham, Kent. 4 *gns*	Qualified librarians	Medway and Maidstone College of Technology and library authorities in area	P. O. Hart, Principal Lecturer, Dept. of Management and Social Studies, Medway and Maidstone College of Technology, Horsted, Maidstone Road, Chatham, Kent
Oct. 23–24	2	Co-ordinate indexing for information retrieval	The Bell Inn, Aston Clinton, nr. Aylesbury. £21	All who are concerned with information retrieval	J. L. Jolley and Partners Ltd.	J. L. Jolley and Partners Ltd., Westbourne House, Westbourne Street, High Wycombe, Bucks
Nov.	4	Mechanized housekeeping	London £15		Aslib	Education Officer, Aslib
Nov.		Work with Patents	Birmingham (?) 8 *gns*	Library or Information staff	Aslib	Education Officer, Aslib
Nov.	4	Business records	London		Aslib and Business Archives Council	Education Officer, Aslib
*Dec. 16–20	5	Scientific literature and its guides	NLL Accommodation cost only	University Academic staff	NLL	Dr K. P. Barr, NLL

COURSES WITH DATES NOT PRECISELY SPECIFIED

Dates	*Total no. of days*	*Subject*	*Location and cost*	*For whom intended*	*Organization and Collaborators*	*Inquiries to*
*April/May 1968	1	The book and the school library	Ealing Technical College	School librarians, public librarians, teachers	Ealing Technical College	Division of Librarianship, Ealing Technical College, St. Mary's Road, Ealing, London W5
April/May 1968	4–6	Seminar on library management for senior librarians	Aberystwyth *ca* £25	Senior librarians in libraries of Wales	College of Librarianship, Wales	Principal, College of Librarianship, Wales, Llanbadarn Fawr, Aberystwyth
*April/July 1968	5	Library services in the new polytechnics	Leeds/Harrogate ND	Senior library staff in the proposed polytechnics	Leeds College of Commerce	D. Daintree, Esq., Dept. of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1
*May 1968	4	Junior introductory course	London. 9 *gns*	Non-graduates in first year library or information work	Aslib	Education Officer, Aslib
*May 1968	8	Classification	London		Aslib	Education Officer, Aslib
May 1968	1	Writing and publishing of children's books	Aberystwyth Nominal	All interested	College of Librarianship, Wales	F. Keyse, College of Librarianship, Wales, Llanbadarn Fawr, Aberystwyth

* tentative

COURSES WITH DATES NOT PRECISELY SPECIFIED—*continued*

Dates	*Total no. of days*	*Subject*	*Location and cost*	*For whom intended*	*Organization and Collaborators*	*Inquiries to*
*May 1968		Course on patents	Liverpool		College of Commerce, Liverpool	B. Houghton, School of Librarianship, Dept of Professional Studies, College of Commerce, Tithebarn Street, Liverpool 2
*Summer 1968	*ca* 5	Mediaeval manuscripts	Edinburgh	Members of the staffs of national and university libraries concerned with mediaeval manuscripts, and possibly visiting colleagues from abroad	SCONUL	Dr E. F. D. Roberts, Librarian, Trinity College, Dublin 2, Eire
*Summer 1968	*ca* 7	Bibliography	Oxford. *ca* £15	Members of staffs of national and university libraries and possibly visiting colleagues from abroad	SCONUL	Dr K. W. Humphreys, Librarian, University Library, Edgbaston, Birmingham 15
†Summer 1968	1 wk.	Technical German	Ealing	Special librarians	Ealing Technical College	Division of Librarianship, Ealing Technical College, St. Mary's Road, Ealing, London W5
*June 1968	5	Introduction to mechanization	London		Aslib	Education Officer, Aslib
*June 1968	5	Hospital librarianship	London	Secretary/librarians	Aslib	Education Officer, Aslib

*July 1968	4	Junior introductory course	Provinces. 9 *gns*	Non-graduates in first year library or information work	Aslib	Education Officer, Aslib
*July 1968	2–3	Medical bibliography—sources, methods and services	Sheffield	The medical profession	Postgraduate School of Librarianship and Information Science, The University, Sheffield	Postgraduate School of Librarianship and Information Science, The University, Sheffield
*Autumn 1968		Course for secretary/librarians in law libraries	*ca* £15 (including accommodation)	Part-time librarians in small law libraries	Leeds College of Commerce	D Daintree, Esq., Dept. of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1
*Sept. 1968	10	Systems analysis		Senior library and information staff	Aslib	Education Officer, Aslib
*Oct. 1968	9	Senior introductory course	London. 25 *gns*	Graduates in first year library science	Aslib	Education Officer, Aslib
Sept. 1968	*ca* 1 week	Workshop in the literature and librarianship of the social sciences			Leeds College of Commerce	D. Daintree, Esq., Dept. of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1
*Sept/Oct 1968	2	Methods of conducting library surveys	Leeds/Harrogate	Senior staff in various types of library	Leeds College of Commerce	D. Daintree, Esq., Dept. of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1

* tentative

NATO Symposium

The Avionics and Technical Information Panels of the Advisory Group for Aerospace Research and Development, AGARD–NATO, will hold a symposium on 'Storage and retrieval of information; a user-supplier dialogue', at the Künstlerhaus, Lenbachplatz 8, Munich, from Tuesday 18th to Thursday 20th June 1968. Papers will deal with the present state of the art and will show potential users how storage and retrieval concepts can assist in the handling of scientific and technical information.

Attendance is by invitation (there is no fee), and those interested should write to Mr A. H. Holloway, Ministry of Defence, Naval Scientific and Technical Information Centre, Block A, Station Square House, St Mary Cray, Orpington, Kent.

Verlag Dokumentation publications

CBD Research Ltd have recently announced that four titles of interest to libraries should in future be ordered from them instead of from the publishers.

These are: *Deutsches Universitäts—Handbuch*;
Internationales Bibliotheksaddressbuch;
Internationales Verlagsaddressbuch;
Internationale Bibliographie der Fachzeitschriften
(CBD Research Ltd, 114 High Street, Beckenham, Kent).

REVIEW

ISRAEL. Centre for Scientific and Technological Information. *Directory of current research in Israel.* COSTI 1967. 457 p. (Guides to sources of information series: directory No. 5).

This volume is the result of the first survey undertaken by the Centre of Scientific and Technological Information on current research in Israel in the fields of theoretical and applied science, including medicine, agriculture, engineering and technology. The survey attempted a wide coverage, including institutions of higher learning, research institutions and laboratories, both government-owned and independent.

Approximately 3,500 individual research projects and 2,710 scientists are covered, but since this is the first such survey, there are some inaccuracies and gaps in coverage which are expected to be eliminated in the next directory. A more complete explanation of the arrangement and use of the directory, included in the main body of the volume, instead of a loose sheet, would also be helpful. In addition an improvement in the print particularly in the closely packed index would be welcome, and full addresses for obtaining further information from the organizations listed would greatly increase the value of the directory. On a whole, however it is conveniently arranged by subject and easy to use. Projects are fairly specifically titled, and well indexed by keyword, institution and individual author. This volume is in fact a useful addition to the directories covering research and library facilities and activities in Israel, though the price may be thought somewhat high in view of the relatively poor print and binding.

Evening meetings at Headquarters

Members are reminded that the separate notices about HQ evening meetings have been discontinued. Entries will be listed in the Calendar each month and a descriptive paragraph will be published in the text in *Aslib Proceedings* a month or two in advance of each event.

The next evening meeting will be the Second Aslib Annual Lecture on Tuesday 23rd April (admission by ticket only). Another meeting is scheduled for Thursday 23rd May (see next paragraph).

Following the usual Aslib practice, a prominent overseas documentalist has been invited to speak at an Aslib meeting during his sojourn in England. He is Dr Udo Schützsack of the German Institut für Dokumentationswesen, Frankfurt-am-Main. He will speak on Wednesday 8th May 1968 at Aslib beginning at 5.30 p.m. about some of the current work of the Institut. His theme will be 'Information policy in Germany, with special reference to the food, agriculture and forestry project'. Members interested in hearing more about this meeting are invited to contact the Meetings Organizer, Aslib.

An Industrial Patent Agent Looks at his Work

At the evening meeting at Aslib on Thursday 23rd May 1968 the chair will be taken by Miss M. F. Webb, Keeper, National Reference Library for Science and Invention, and a Chartered Patent Agent, working in one of our large industrial concerns, will discuss some aspects of his job and of the patents system within the framework of which he has to work. He will indicate analogies between the methods of the information officer and those of the patent agent, particularly with regard to information retrieval. Among other matters he will consider the procedures involved in the examination and publication of patents and possible ways of speeding up the process, including mechanization.

Members wishing to attend this meeting are asked to notify the Meetings Organizer, Aslib, *not later than 24th April,* and to note that, apart from a brief reminder in next month's calendar, there will be no further notification about this meeting.

Aslib Courses on Mechanization

A new course entitled 'Introduction to Mechanization' will be held at Aslib Headquarters from Monday 27th to Thursday 30th May. A copy of the prospectus and application form is included in this issue. The fee for the course will be 15 guineas. Students should be experienced information staff or special librarians, but will not be expected to have had previous experience of mechanized systems. Numbers on the course will be strictly limited, so applications should be made early on the application form provided. Provisional booking will be accepted by telephone or telex.

This is the first of a series of courses that are being planned to cover various aspects of mechanization as applied to special libraries and information services. The introductory course will provide a general survey of the whole subject at a fairly elementary level, showing both the pitfalls and the possibilities of mechanization. Although demonstrations of data processing equipment will be included, the course is not intended to equip students to embark on specific applications. Subsequent courses in the series will be more vocational in character, and will include practical work where possible. Those being planned at present are:

Mechanization without computers (i.e. the use of punched cards and punched tape equipment);
Systems analysis;
Mechanization of housekeeping routines;
Mechanization of information retrieval;
Mechanization of current awareness systems.

Further details of these courses will be announced shortly.

AN AUTOMATED LITERATURE RETRIEVAL SYSTEM

R. McG. HARDEN
Lecturer, University Department of Medicine, Western Infirmary, Glasgow

Paper presented at a meeting of the Co-ordinate Indexing Group, Thursday, 7th December 1967

FACED with an unprecented growth in available knowledge it is now almost impossible for the doctor, whether in clinical practice or engaged in research, to keep abreast of current developments. Both the research worker and the clinician would benefit greatly from ready access to papers dealing with their areas of interest. Most have experienced the sense of frustration that arises from knowing that somewhere one has seen a piece of information, but one does not quite know where. The human brain as a storage system is poorly organized and as a retrieval system is chancy at best (*Ann. Int. Med.,* 1967). What is needed is some aid to memory. To obtain an estimate of the magnitude of one aspect of the problem I reviewed papers I published in 1965–66. The total number was thirty-two, the average number of references per paper nineteen and the total number of references cited was 595. This, however, is only the tip of the iceberg and represents only a fraction of the references to be reviewed. It was obvious that some form of automated literature retrieval system was desirable if not essential, and it is the purpose of the present paper to report my experiences of such a system.

References enter the system by several routes—either directly from books or journals or indirectly from current awareness serials, e.g. *Current Contents,* from abstracting serials or from MEDLARS searches.

Each reference is indexed using a list of about 250 key words. This list comprises such terms as DRUG, KIDNEY, and BACTERIA, such concepts as AETIOLOGY, DIAGNOSIS and MEASUREMENT and such ideas as ANTI, INCREASE or DECREASE and EARLY or LATE. Other ideas were defined in terms of the key words listed.

e.g. Antibiotics = DRUG + ANTI + INFECTION.
Cold = decrease (coded as ATROPHY) + TEMPERATURE.
Heat = increase (coded as ENLARGEMENT) + TEMPERATURE.
Contraceptive = ANTI + FOETUS + DRUG.
Electroencephalogram = MEASUREMENT + BRAIN.
Cretinism = EARLY + HYPOTHYROID.
Urine = KIDNEY + EXCRETION.
Thirst = decrease (coded as ATROPHY) + DIET + CLINICAL FEATURES.
Galactorrhoea = increase (coded as ENLARGEMENT) + BREAST + EXCRETION.

For quick access a dictionary is kept in the form of 5 × 3 inch cards on a card wheel (fig. 1).

Each key word is represented by a feature card.[3] Each reference entering the system is given a unique number and all keyword cards appropriate to a reference are punched, using a desk punch, at the position on the card rep-

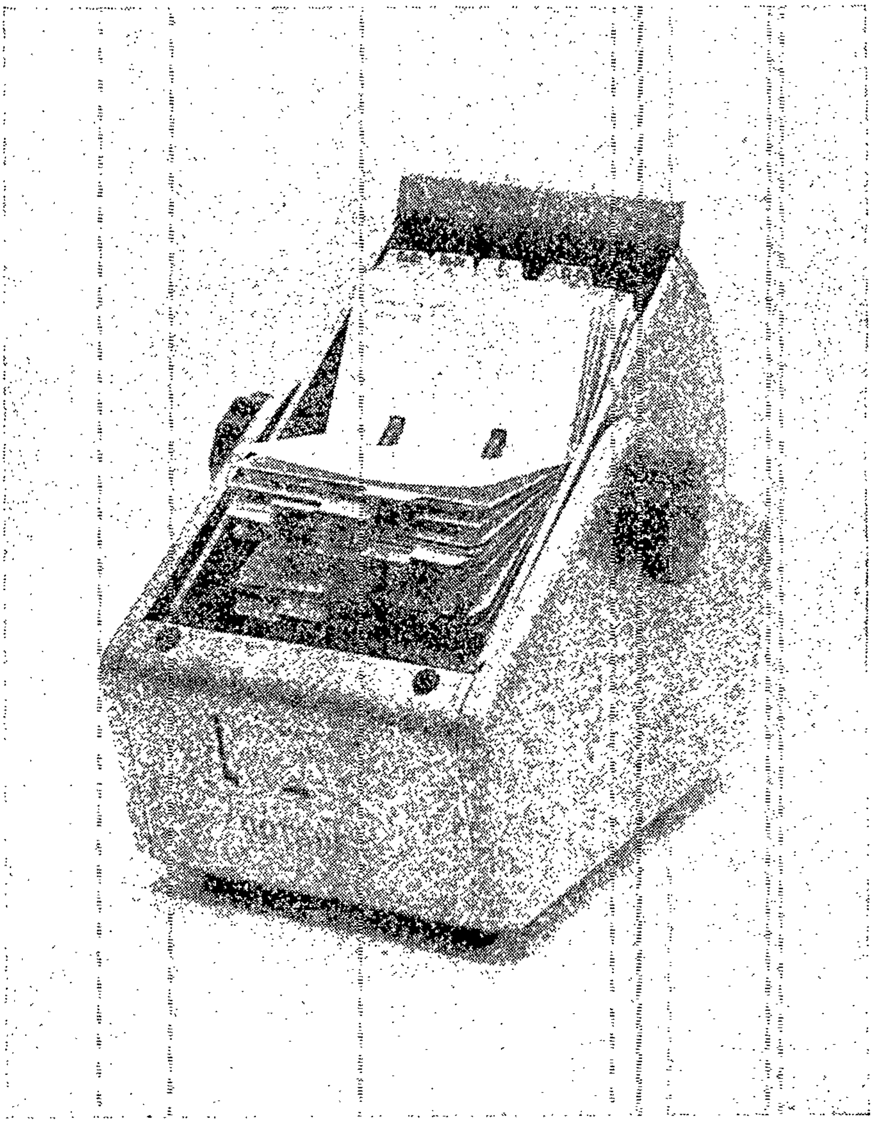


FIG. 1. *Dictionary in the form of 5 × 3 inch cards on a card wheel.*

resenting the number of the reference. A trial was carried out in which two alternative methods of punching were compared in a sample of one hundred references. Firstly all the feature cards for one reference were stacked and punched. This method required the minimum of punching, but cards had to be filed and retrieved individually for each reference from a vertical visible mobile cabinet in which they were stored. On average it required 1·05 minutes/reference. Secondly the references were handled in batches of 20 and a transfer sheet was made out for each batch. This took 0·58 minutes/reference. Each feature card was then taken in turn from the file and punched as indicated on the transfer sheet. This took on average 0·75 minutes/reference. The operation when combined with making out a transfer sheet required 1·33 minutes/reference. The quickest method, requiring only 0.75 minutes/reference and the one we have adopted, is to code the references directly on to transfer sheets and not indirectly as described above in the batch transfer sheet system. The feature cards are then punched in turn from these sheets.

The feature cards are read by stacking; for example all references dealing with the surgical treatment of hyperthyroidism are obtained by stacking the cards SURGERY, TREATMENT and HYPERTHYROIDISM and noting the positions of holes which pass through the stack. Thus a search on the subject of 'absorption of iodine from the gut in hyperthyroidism' would be carried out by stacking the cards ABSORPTION, IODINE and HYPERTHYROIDISM, a search for 'treatment of hyperthyroidism with antithyroid drugs' by stacking the cards TREATMENT, HYPERTHYROIDISM, DRUGS, ANTI and THYROID.

In one recent search for references describing the effect of cold and old age on thyroid function in man the cards were stacked decrease (ATROPHY) + TEMPERATURE + old (LATE) + HUMAN + THYROID + FUNCTION. No holes passed through the stack. A near miss, however, was apparent and by removing from the feature card stack the card HUMAN an appropriate reference was found.

The keyword list has been restricted to about 250 terms. This is smaller than lists used by other workers.[2,4] A small list has certain advantages:

1 It is economical in feature card filing space.

2 Generic terms are coded in many cases automatically, e.g. a search for cold involves stacking the cards—decreased (ATROPHY) + TEMPERATURE and a search for heat, the cards—increased (ENLARGEMENT) + TEMPERATURE. Thus the generic term TEMPERATURE is coded as part of the definition. To take another example, there has been interest recently in the relation between glaucoma and thyroid function. This is coded EYE + DISEASE + increase (ENLARGEMENT) + PRESSURE + THYROID + FUNCTION. Thus it is also possible to retrieve references which deal generally with eye disease and thyroid function in addition to specifically glaucoma and thyroid function.

3 Synonyms are, to a large extent, avoided. For example, the following two references deal with renal handling of iodine in children and were retrieved during a search KIDNEY + EXCRETION + IODINE + EARLY + HUMAN.

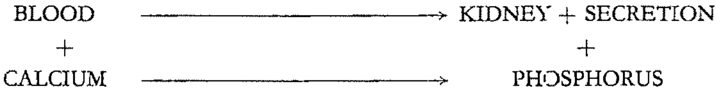
'Lack of correlation between urinary iodine and dietary iodine in goitrous children', and

'Dependence of renal clearance of radio-iodine on sex, age and thyroidal status'.

If, however, the urine had been coded as 'urine' then the first reference might have been missed.

There are, however, some disadvantages. The task of punching is increased and the chance of false drops is much greater. Preventative action was taken to eliminate two types of false drops encountered. An example of the first type is a search for articles dealing with the relation between blood calcium and urine phosphorus. Articles which dealt with blood phosphorus and urine calcium would also be retrieved. To avoid this difficulty I have introduced two operators, one which I have termed an alphabetical operator, the other an anti-alphabetical operator. In the above example in addition to BLOOD + CALCIUM + KIDNEY + EXCRETION + PHOSPHORUS the alphabetical operator would be punched because B in BLOOD comes before K in KIDNEY and C in CALCIUM comes before P in PHOSPHORUS (fig. 2). If, on the other hand, the search had been for articles dealing with 'blood phosphate and urine calcium' the anti-alphabetical operator would have been punched (fig. 2).

(*a*) Alphabetical operator



(*b*) Anti-alphabetical operator

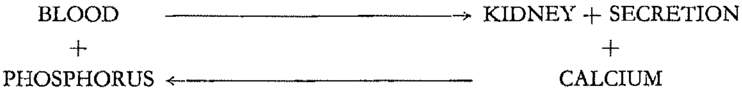


FIG. 2

The second type of false drop occurs when the same term is repeated during one search. For example in a search for articles about the relation between blood calcium and urine calcium, articles about blood calcium and urine phosphorus, magnesium, iodine, etc., would be retrieved. I therefore introduced an operator which I have termed a double operator. This is punched if any term appears twice.

I would like to make three points about the noise associated with the system. Firstly, although theoretically the possibility of noise is high, in practice it is less troublesome than one might have expected. Secondly, the noise can be reduced by the use of operators. The operators I have used have been alphabetical and anti-alphabetical, double, negative (the use of this is described below) and abnormal. Thirdly, when false drops do occur, the inconvenience can be kept to a minimum if an efficient output system is used.

Below are considered examples of some recent searches. The results of a search for references concerning contraceptives and thyroid function are shown in table I. Examples are:

'Thyroid status in pregnancy and in women taking oral contraceptives . . .'
'Oral contraceptives and thyroid function tests . . .'
'Contraceptives and tests of thyroid function . . .'
'Norethynodrel-mestranol and thyroid function . . .'
'Thyroid function and enovid . . .'

The false drop was

'Neonatal goitre after maternal propylthiouracil therapy.'

This had been coded GOITRE + FOETUS + EARLY + HUMAN + PREGNANCY + ANTI + THYROID + DRUG + TREATMENT. The ANTI + DRUG referred, however, to the thyroid, not to the FOETUS.

Forty-three references were retrieved in a search for references on sweat coded as SKIN + EXCRETION (table 2). The false drop was 'Iodine in children's hair: its relation to urinary iodine levels.' This had been coded IODINE + EARLY + HUMAN + hair (SKIN) + KIDNEY + EXCRETION + DOUBLE OPERATOR. Hair and skin were coded on the same card and in this example the excretion referred to the kidney, not to the skin.

In a search for articles about the triiodothyronine suppression test (table 3) it could be confirmed that no article had been missed in the search as all articles on this subject had been photostated and stored together in a file.

The noise incidence was unusually high in the search described in table 4. This was due partly to bad vocabulary and partly to faulty search technique. In addition to referring to temperature COLD could also be used in the dictionary as a descriptor of one type of thyroid nodule. This accounted for the false drops. As soon as the high incidence of false drops in the search was noted, preventative measures could be taken. Firstly the card FUNCTION could be added to the stack as it could be assumed that one was looking for the relationship between thyroid function and cold in contrast to thyroid disease and cold or secondly the references dealing with nodules and the thyroid could be excluded by the Negative Operator, i.e. ATROPHY + TEMPERATURE + THYROID – NODULE. The Negative Operator is a yellow transparency which when placed in the stack in front of the appropriate feature card indicates as yellow circles those references which do not possess this feature.

In a search for saliva iodide no noise was generated (table 5). Of the forty-seven references, in twenty-eight the subject was included in the title, in eleven the concept was hinted at in the title and in eight there was no obvious clue to salivary iodide in the title.

When the feature card system was first used the references were typed on perforated sheets of white gummed paper made up in sets of five sheets with interleaved carbons. These were then stuck on 5 × 3 inch cards of different colours and three sets were filed centrally in a conventional blind filing system—one set filed numerically, one alphabetically according to the first author and one alphabetically according to the second author. This system had three disadvantages:

Subject of inquiry	TRIIODOTHYRONINE SUPPRESSION TEST
Keywords	TRIIODOTHYRONINE + SUPPRESSION + test (METHOD) + DIAGNOSIS
No. of references retrieved	12
Noise	1/12
Noise due to punching error	0
Noise due to coding error	1
Noise due to 'false drop'	0
No. of references *not* retrieved	0

TABLE 3

Subject of inquiry	COLD AND THE THYROID
Keywords	decreased (ATROPHY) + TEMPERATURE + THYROID
No. of references retrieved	22
Noise	12/22
Noise due to punching or coding error	0
Noise due to bad search strategy	12
Noise due to bad vocabulary	12

TABLE 4

Subject of inquiry	SALIVA IODIDE
Keywords	SALIVA + GLAND + EXCRETION + IODINE
No. of references	47
Noise	0/47

TABLE 5

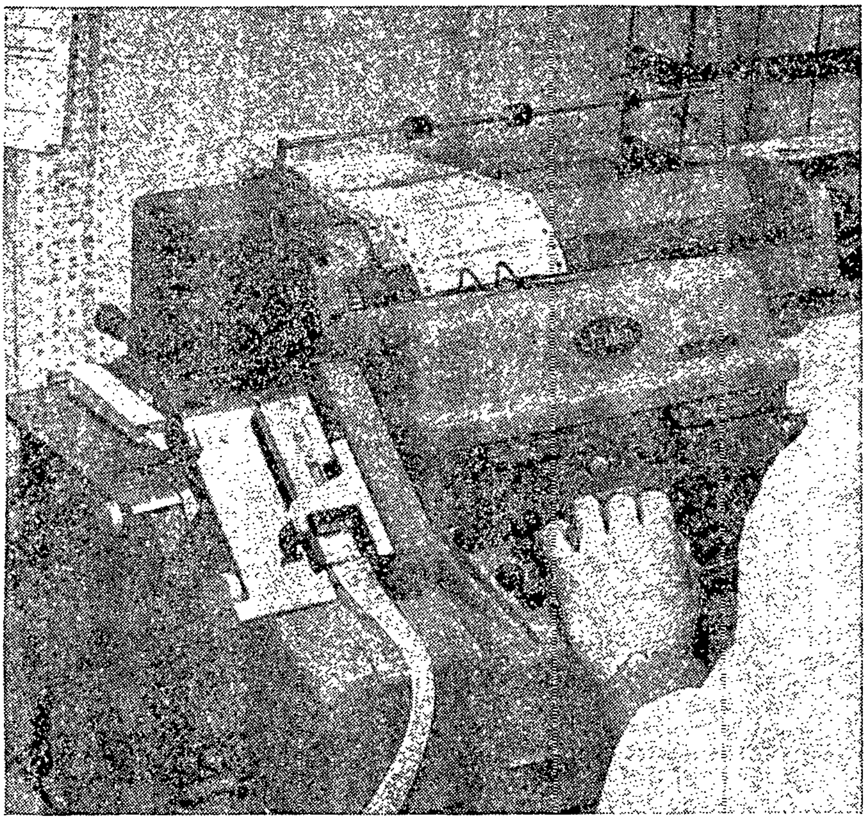


FIG. 3. *Automatic typewriter (Flexowriter) printing labels from paper tape.*

1 The number of copies of sets of references prepared initially had to be limited as a maximum of five sets could be prepared with the carbon.
2 The retrieval of cards from the blind file was time-consuming.
3 At a later date to prepare a list of references resulting from a search the details had to be copied from the cards. This took a considerable time and the possibility of errors was introduced.

To overcome these disadvantages we are now using an automatic typewriter and edge-tracked cards. A paper tape was punched, governed by a control tape for spacing, carriage returns, etc. The tape was then checked for errors. Four forms of output from the tape were used (fig. 3).

1 Reproduction on continuous edge-punched cards, each when divided holding a complete reference for quick retrieval at any time. For ease of identification these were each labelled with a printed self-adhesive label.
2 Continuous 5 × 3 inch cards for the alphabetical author file and for individual personal files.

3 Continuous, detachable, self-adhesive labels retrieved by the selection code which allows for the variation in size and spacing between the cards and the labels. These were used with the edge-tracked cards, reprint requests, correspondence, etc.

4 Lists which could be circulated to interested persons.

To determine whether a standard size of edge-tracked card could be adopted, the number of characters per reference was estimated in 500 references (fig. 4). The number was found to vary from < 50 to > 300. It was therefore decided to use continuous 7 × 3 inch edge-tracked cards which could be divided as appropriate. These cards were folded and stored in a vertical visible cabinet (fig. 5). In the cabinet each card was immediately visible. Those that were relevant to a search could be quickly removed from the cabinet, passed through the automatic typewriter and a list of references was thus produced.

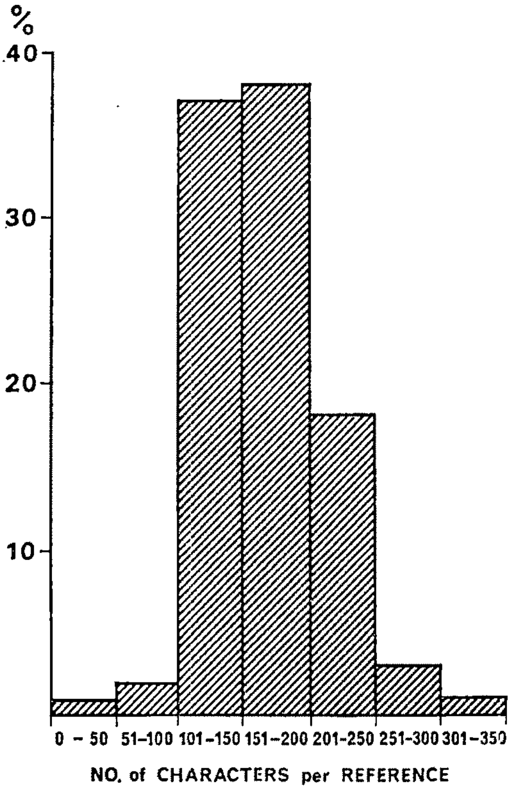


FIG. 4. *Number of characters per reference in 500 references.*

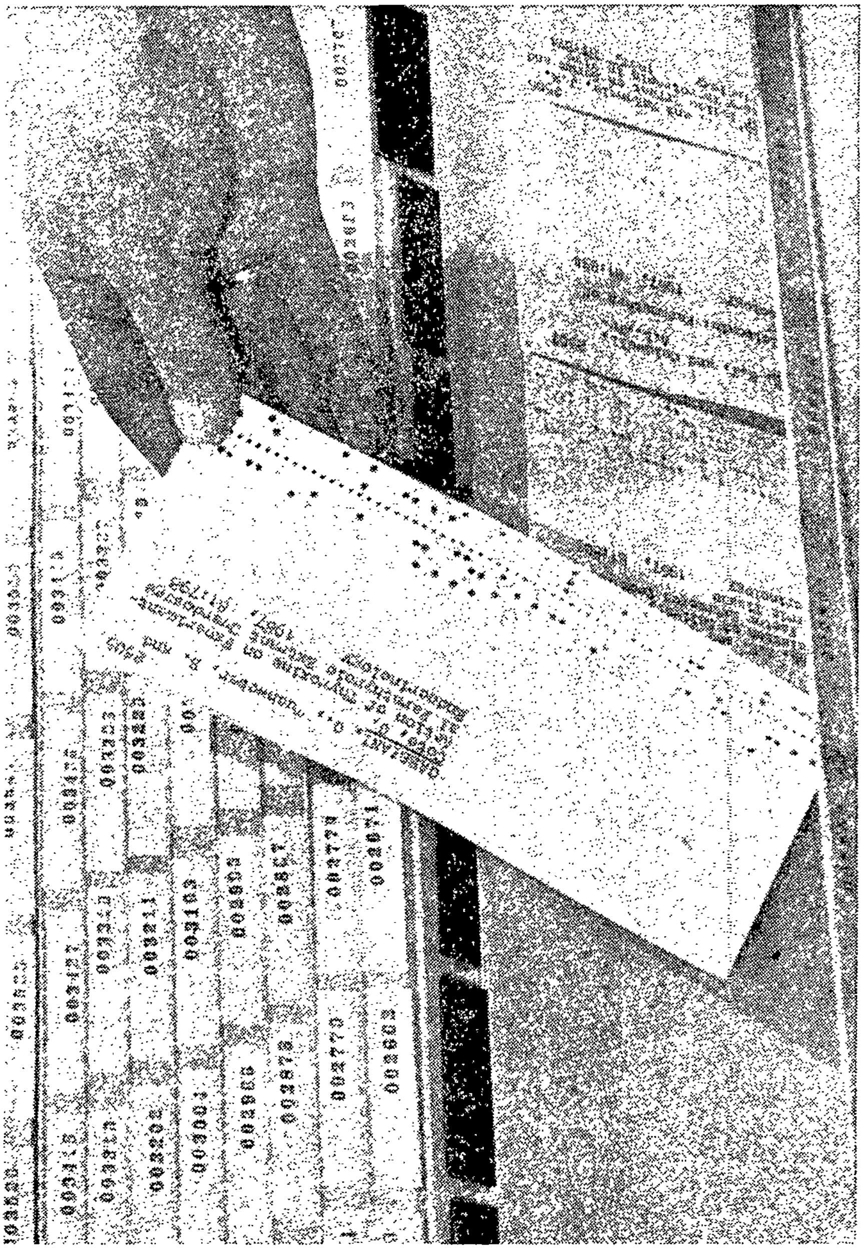


FIG. 5. *Edge-tracked cards filed in vertical visible filing unit.*

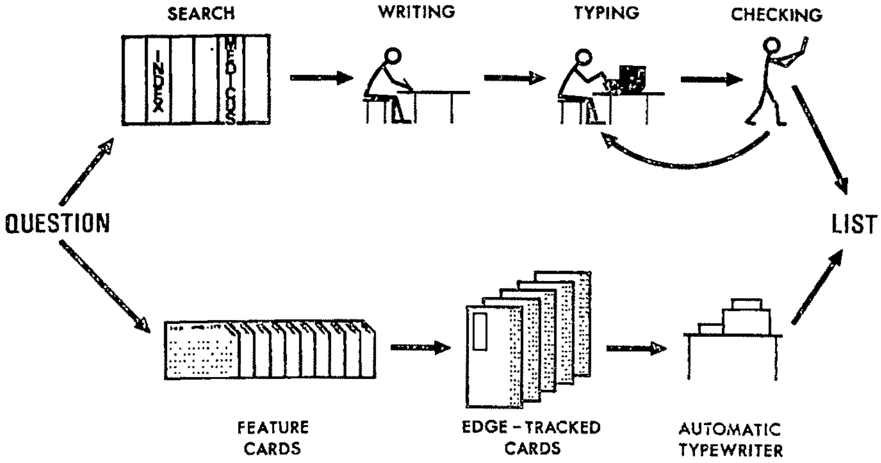


FIG. 6. *Comparison between two methods of literature retrieval.*

Photocopies or reprints of many of the articles were filed in a lateral filing unit alphabetically according to the main subject headings. The file in which a reference could be located was recorded on the edge-tracked cards. A subject rather than a numerical filing system was chosen as the file which contained the required reference could be quickly located from the edge-tracked cards and in a search a large proportion of the reprints required tend to be located under one subject heading.

The system I have described has many advantages:

1 Doctors working on a research project or in clinical practice are impatient people and this system is a tremendous advantage as it gives a rapid answer to a specific query.
2 Each individual or group of individuals can retain their own set of item and feature cards.
3 Near misses are spotted and the search procedure can be modified.
4 There is the minimum time delay in getting the published literature into the system. Medicine is advancing rapidly and the references published in the preceding six months are very important.
5 The individual can be selective in deciding which references to include.
6 One need not be limited to current references and older ones, where appropriate, can be included.
7 Lists of references can be quickly and accurately produced.

In conclusion old methods required laborious searches including hand listing of the references, typing of the references and checking and subsequent correction of any errors (fig. 6). In contrast, with the system I have described searches are quicker, typing avoided and accuracy guaranteed.

Acknowledgments

I am grateful to Mr J. L. Jolley for encouragement, to Mrs McClafferty for technical assistance and to the Scottish Hospital Endowment and Research Trust for financial support.

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2 BLAGDEN, J. F. How much noise in a role-free and link-free co-ordinate indexing system. *Journal of Documentation*, vol. 22, 1966. p. 203–9.
3 JOLLEY, J. L. Punched feature cards. *Data Processing*. April-June 1959, p. 4–11.
4 MCCLELLAND, R. M. A., *and* MAPLESON, W. W. Feature cards: a method of indexing anaesthetic literature. *Anaesthesia*, vol. 21, 1966. p. 3–18.

Subject of inquiry	CONTRACEPTIVES & THYROID
Keywords	ANTI + FOETUS + DRUG + THYROID
No. of references retrieved	9
Noise	1/9
Noise due to punching or coding error	0
Noise due to 'false drop'	1

TABLE 1

Subject of inquiry	SWEAT
Keywords	SKIN + EXCRETION
No. of references retrieved	43
Noise	1/43
Noise due to punching or coding error	0
Noise due to 'false drop'	1

TABLE 2

ASLIB CIG RESEARCH PROJECT: PROGRESS REPORT I*

H. F. DAMMERS
Woodstock Agricultural Research Centre

Introduction

TWO years ago in March 1966 Dr Batten suggested that the newly formed Co-ordinate Indexing Group should embark on a constructive co-operative project, preferably one that would involve all members willing to participate in such a venture.

His proposal, which was accepted by the CIG Committee at their first meeting, entailed the indexing of a readily available collection of documents (the second leader from *The Times*) for a period of three months; this was to provide data upon which could be based a study of indexer performance and thesaurus construction. It was hoped that a 'thesaurus' based on the keywords used in the first phase might be used for a second phase of indexing, again extending over a period of three months. Indexer performance would then again be evaluated and the total collection (1st and 2nd phase) and its associated thesaurus used in retrieval experiments perhaps by a suitable outside body.

For various reasons, progress has not been as fast as originally hoped; the present report deals only with the work done so far in the 1st phase. However, it would appear that even the material obtained in this first part of the project, which was executed under the guidance of Mr A. Gilchrist (Aslib Research Dept) and the present author, provides a valuable basis for the study of indexing performance.

The Indexing Stage

This consisted of indexing the second leader of *The Times,* starting with the Friday 1st April 1966 issue and continuing for a period of thirteen weeks till the end of June (in all seventy-seven issues). Twenty-one members of the Group participated, representing a good cross-section of co-ordinate indexing skill available in the Group; in addition, a group of similar size, consisting of twenty members of the Standard Telephones and Cables Ltd. joined in, most of them only for part of the project. They were, we understand, mainly computer engineers, programmers, and system analysts, and they provided a very useful control group. Details of the indexer group are given in fig. 1.

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* The present report is a slightly modified version of the one presented at the Annual General Meeting of the Aslib Co-ordinate Indexing Group on 15th January 1968.

Indexer Code No.	
1–20 34	CIG members mainly professional indexers *ca.* 80 per cent chemists/engineers *ca.* 20 per cent librarians
21 23–33 35–47	control mainly computer technologists (programmers, system analysts, engineers)
Total: 46	

FIG. 1. *Composition of indexer groups*

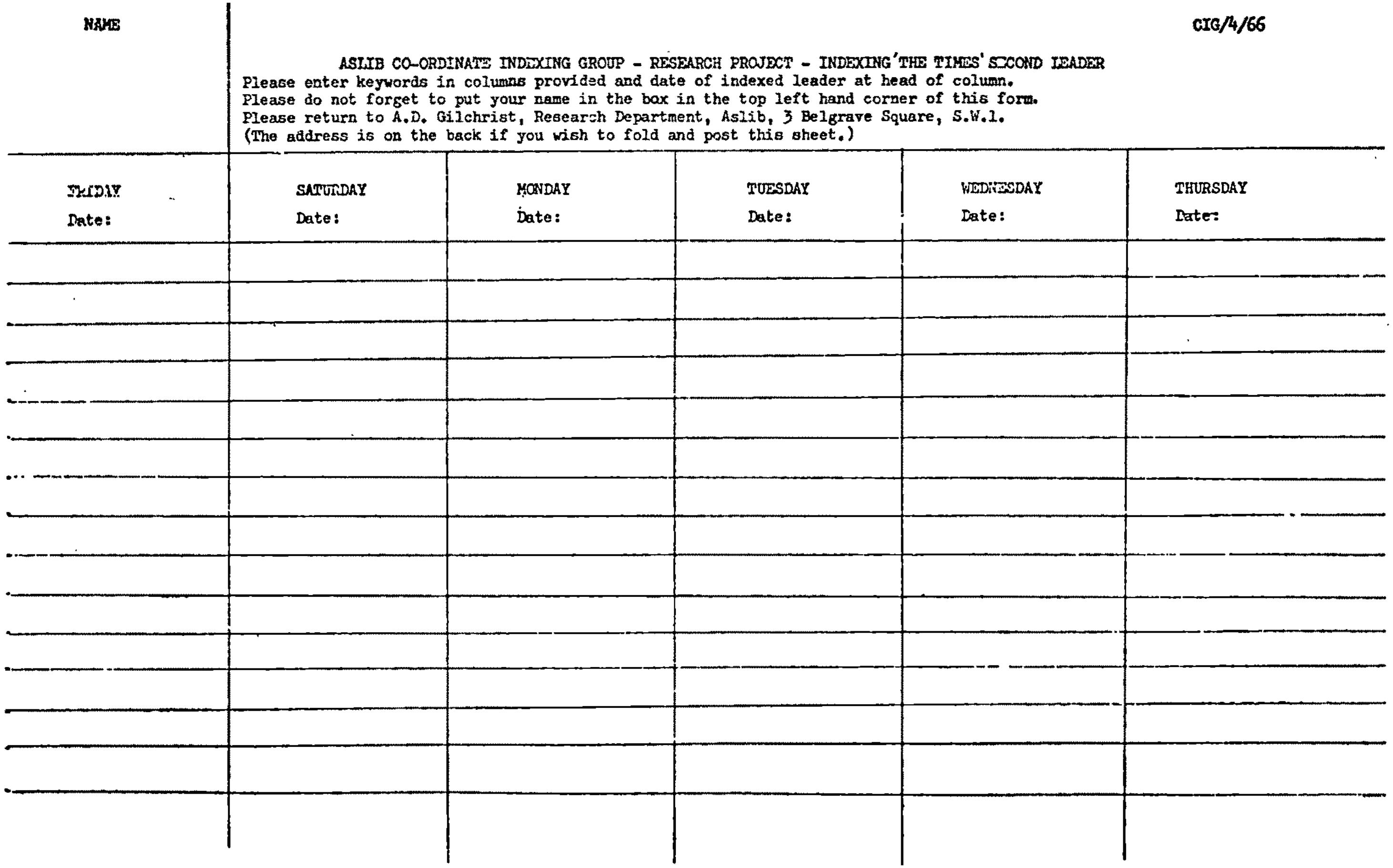
Each indexer was sent indexing sheets, each of which could accommodate one week's indexing (fig. 2); they allowed the use of up to fifteen keywords per leader. No rules or standards were laid down so that indexers were left free to follow their own principles and inclinations. Hence they could select keywords from the text, from an authority list etc. Roles were not to be used. Not surprisingly this freedom, left to the indexer to follow his own inclination, gave rise to complaints on the lack of guidance and purpose, particularly from the scientists among the indexers, who seemed rather unhappy with the subjects indexed. Nevertheless, an appreciable proportion stuck with the project till the end; fig. 3 tabulates the coverage achieved. Altogether they assigned 21,745 keywords, a not inconsiderable achievement.

No. of documents	*No. of Indexers*	*No. of document analyses*
77	18	1386
74	1	74
30–45	5	182
29	9	261
13–28	7	153
6–12	6	59
	46	2115

FIG. 3. *Coverage (Number of documents indexed)*

Preliminary Processing of the Data

From the start it was decided to use mechanical data processing where feasible for the analysis of the data obtained. This was considered essential if full benefit was to be derived from the considerable volume of data generated by the project. However, it has also meant a considerable initial delay in the evaluation work. Aslib did not at the time have the resources to undertake the data processing aspects, hence it was necessary to make use of facilities provided by member organizations of Aslib. In order for this to be feasible, the work had to be carried out as a stop-gap between normal operational duties. As a



NAME

CIG/4/66

ASLIB CO-ORDINATE INDEXING GROUP - RESEARCH PROJECT - INDEXING 'THE TIMES' SECOND LEADER
Please enter keywords in columns provided and date of indexed leader at head of column.
Please do not forget to put your name in the box in the top left hand corner of this form.
Please return to A.D. Gilchrist, Research Department, Aslib, 3 Belgrave Square, S.W.1.
(The address is on the back if you wish to fold and post this sheet.)

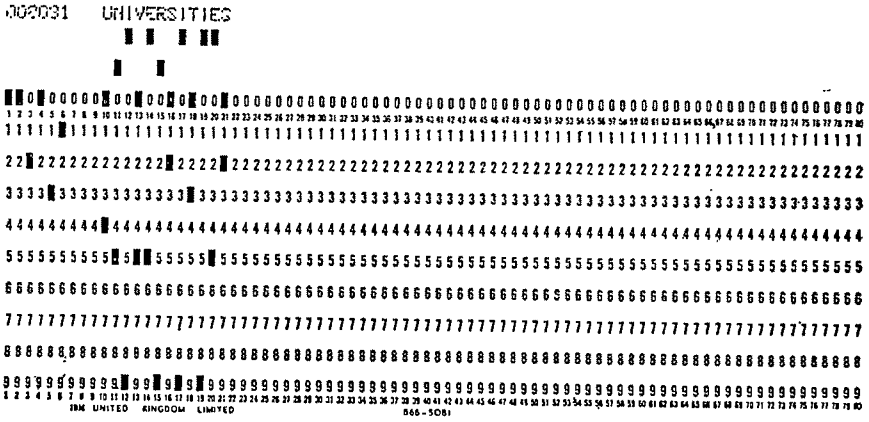
FRIDAY Date:	SATURDAY Date:	MONDAY Date:	TUESDAY Date:	WEDNESDAY Date:	THURSDAY Date:

FIG. 2. *Indexing sheet.*

result the keypunching of the data alone took several months to complete. This task was made more arduous by the nearly illegible writing of some of the indexers and the occurrence of rather more spelling mistakes than one would have expected from such an erudite group of professionals (it might have been interesting to collect some statistics on this).

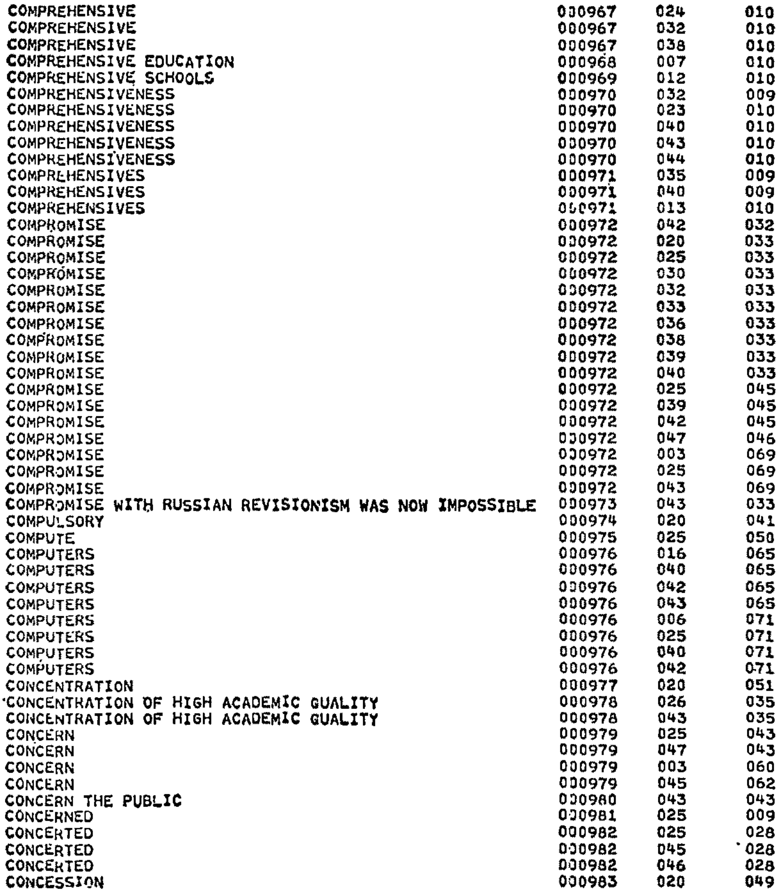
In order to achieve maximum flexibility, it was decided to enter each keyword used on a separate punched card together with a code number for the indexer and the document as illustrated in fig. 4. This particular example indicates that indexer number 2 used the term 'universities' when indexing document number 31.

With all the keywords entered on to punched card in fixed field arrangement, it was, of course, possible to order and select the data via a punched card sorter. Some of the earlier analysis attempts were indeed done in this way, e.g. in order to see what the keyword collection looked like for a given indexer or document. It was obvious, however, that punched card processing would be a much too laborious procedure for the whole collection to be handled in this way. Hence arrangements were made to use, where feasible, computer facilities. Here again, in order to make it acceptable to the host organization concerned, we had to do this in such a manner that it would interfere as little as possible with normal operational duties. As regards programming, use was made of people such as vacation students; in some cases the programming jobs were also undertaken as part of a computer training programme. Again it meant that delays were unavoidably associated with this type of approach; they were further aggravated by the fact that different types of computers were used in various stages of the evaluation work.



col. 1 - 3 indexer number
col. 4 - 6 document number
col.10 - keyword

FIG. 4. *Punched card with keyword and code numbers for indexer and document.*



```
COMPREHENSIVE                                           000967   024      010
COMPREHENSIVE                                           000967   032      010
COMPREHENSIVE                                           000967   038      010
COMPREHENSIVE EDUCATION                                 000968   007      010
COMPREHENSIVE SCHOOLS                                   000969   012      010
COMPREHENSIVENESS                                       000970   032      009
COMPREHENSIVENESS                                       000970   023      010
COMPREHENSIVENESS                                       000970   040      010
COMPREHENSIVENESS                                       000970   043      010
COMPREHENSIVENESS                                       000970   044      010
COMPREHENSIVES                                          000971   035      009
COMPREHENSIVES                                          000971   040      009
COMPREHENSIVES                                          000971   013      010
COMPROMISE                                              000972   042      032
COMPROMISE                                              000972   020      033
COMPROMISE                                              000972   025      033
COMPROMISE                                              000972   030      033
COMPROMISE                                              000972   032      033
COMPROMISE                                              000972   033      033
COMPROMISE                                              000972   036      033
COMPROMISE                                              000972   038      033
COMPROMISE                                              000972   039      033
COMPROMISE                                              000972   040      033
COMPROMISE                                              000972   025      045
COMPROMISE                                              000972   039      045
COMPROMISE                                              000972   042      045
COMPROMISE                                              000972   047      046
COMPROMISE                                              000972   003      069
COMPROMISE                                              000972   025      069
COMPROMISE                                              000972   043      069
COMPROMISE WITH RUSSIAN REVISIONISM WAS NOW IMPOSSIBLE  000973   043      033
COMPULSORY                                              000974   020      041
COMPUTE                                                 000975   025      050
COMPUTERS                                               000976   016      065
COMPUTERS                                               000976   040      065
COMPUTERS                                               000976   042      065
COMPUTERS                                               000976   043      065
COMPUTERS                                               000976   006      071
COMPUTERS                                               000976   025      071
COMPUTERS                                               000976   040      071
COMPUTERS                                               000976   042      071
CONCENTRATION                                           000977   020      051
CONCENTRATION OF HIGH ACADEMIC GUALITY                  000978   026      035
CONCENTRATION OF HIGH ACADEMIC GUALITY                  000978   043      035
CONCERN                                                 000979   025      043
CONCERN                                                 000979   047      043
CONCERN                                                 000979   003      060
CONCERN                                                 000979   045      062
CONCERN THE PUBLIC                                      000980   043      043
CONCERNED                                               000981   025      009
CONCERTED                                               000982   025      028
CONCERTED                                               000982   045      028
CONCERTED                                               000982   046      028
CONCESSION                                              000983   020      049
```

FIG. 5. *Specimen page of computer print-out of alphabetical master file.*

After this rather prolonged apologetic introduction, it is time to give an outline of the work actually done.

In the first place, all the keyword records were written on to magnetic tape in indexer order, under each indexer in document order, under each document in alphabetical order; this file was then sorted into an alphabetically arranged master file. At the same time, five-digit serial code numbers were assigned to each keyword. The master file tape thus contained every keyword used together with an identification of the document to which it was assigned and of the indexer who assigned it. Hence it was in effect a concordance. All identical keywords received the same serial code number. Figs. 5 and 6 give specimen pages of the print-out of this tape. They also illustrate some of the idiosyncrasies of our indexing colleagues (see term 973). It is perhaps not surprising to see that the term no. 976 'computers' was used by seven of the computer technologists and only by two of the co-ordinate indexing experts. However, term

```
INFLATION                            002470    025       044
INFLATION                            002470    031       044
INFLATION                            002470    032       044
INFLATION                            002470    036       044
INFLATION                            002470    046       044
INFLATION AND DEFLATION              002471    010       023
INFLATION (UK)                       002472    041       006
INFLATION (UK)                       002472    041       023
INFLATIONARY                         002473    043       006
INFLATIONARY CONTROL                 002474    039       006
INFLUENCE                            002475    014       009
INFLUENCE                            002475    025       026
INFLUENCE                            002475    046       027
INFLUENCE                            002475    016       052
INFLUENCE                            002475    016       067
INFLUENCE                            002475    025       070
INFLUENCE                            002475    004       072
INFLUENCED                           002476    025       037
INFORMATION                          002477    034       015
INFORMATION                          002477    035       015
INFORMATION                          002477    037       015
INFORMATION                          002477    003       043
INFORMATION                          002477    004       043
INFORMATION                          002477    005       043
INFORMATION                          002477    006       043
INFORMATION                          002477    008       043
INFORMATION                          002477    019       043
INFORMATION                          002477    020       043
INFORMATION                          002477    025       043
INFORMATION                          002477    027       043
INFORMATION                          002477    028       043
INFORMATION                          002477    030       043
INFORMATION                          002477    032       043
INFORMATION                          002477    034       043
INFORMATION                          002477    036       043
INFORMATION                          002477    038       043
INFORMATION                          002477    040       043
INFORMATION                          002477    044       043
INFORMATION                          002477    046       043
INFORMATION                          002477    025       050
INFORMATION                          002477    025       062
INFORMATION                          002477    042       062
INFRASTRUCTURE                       002478    021       013
INFRASTRUCTURE                       002478    025       013
INGENIOUS                            002479    025       018
INGENUITY                            002480    025       062
INHERITED                            002481    003       054
INHERITED                            002481    039       054
INHIBITATION                         002482    003       043
INHIBITS                             002483    042       043
INHIBITS                             002483    046       043
INIATIVE                             002484    024       044
INITIATIVE                           002485    028       002
INITIATIVE                           002485    039       002
```

FIG. 6. *Specimen page of computer print-out of alphabetical master file.*

no. 2477 'information' listed in fig. 6, was also used much more frequently by the computer people (17×) than by the indexing experts (7×). The master tape and its print-out (*ca.* 400 pages) contain a wealth of information, provided one is prepared to spend the effort needed to extract it. In addition, two more files with corresponding print-out were prepared, i.e. one giving for each indexer an alphabetical listing of all the keywords used by him and the other listing similarly the keywords used for each document hence in all 46 + 77 = 123 alphabetical lists, containing on average *ca.* 350 terms each.

Of the nearly twenty-two thousand keywords used, about one quarter were different terms or phrases, hence, each of these was used nearly four times on average (see fig. 7). Not all the seventy-seven documents were analysed by each of the forty-six indexers resulting in only 2,115 documents analyses instead of 3,542. The average number of keywords used per document proved to be about ten, or as much as one keyword per forty to fifty text words appearing in the original. The indexers, though, appeared to reduce the number of keywords per document as they progressed through the indexing phase. Nevertheless, the ratio of keywords to text words is rather high, but this is partly due to the fact that the computer will consider a plural or adjective to be quite different from a singular noun. If one were to correct for this, one would probably find the number of keywords used per document to be nearer six. However, this remains to be confirmed.

A 21745 keywords in alphabetical order
B 5566 specific keywords × 25.5 per cent of A
C Average use of each keyword: $\frac{A}{B} = 3.9$
D Number of document analyses 2115
E Average number of keywords used per document per indexer $\frac{A}{D} = 10.3$

FIG. 7. *Master file: statistics*

Some Numeric Type Analyses

1 One of the simplest types of analysis one can apply to a collection of data, such as those contained in the alphabetical master file, is a listing of the most frequently used keywords.

In our case, this should give us an indication of the type of topics discussed in the second leader of *The Times* and more particularly of the type of events during the period April–June 1966 that stirred the Editor to commit a leader to it.

We should stress here again that the analysis was done on basis of terms the similarity or dissimilarity of which was determined by computer sorting, i.e. in a very literal manner. Hence, governmental, government and governments are three different terms; we could, of course, have eliminated such variation by truncation, i.e. by sorting on a field of say six or eight characters only instead of the full term, butthis is a separate exercise that may.be well worth undertaking at a later date. Neither was any effort made to cluster terms via synonymity and association. The list contains not only entries for Britain but also Great Britain (five), UK (eighteen), United Kingdom (ninety-six) and U.K. (fifty-three). Our analysis, however, is based on the very simple premise that if the computer sort finds the term to be different as regards number, type or arrangements of characters, then it is counted as a different term. On this basis, we selected the terms which occurred more than fifty times in the master file.

Fig. 8A shows the terms occurring at least 125 times and those in the range 76–125 times. As one might expect, the highest frequency group 126–225 × contains the terms which are probably the most frequently used in any set of *Times* leaders, from whatever period, with the possible exception of 'China', but in the range 76–125 × terms begin to creep in which are indicative of matters which were topical at the time, e.g. Rhodesia, Malaysia. All the other terms are again likely to feature whatever quarterly period one had taken.

126 × 250 ×	
Britain	237
Government	199
China	172
Politics	134
76–125 ×	
Rhodesia	105
Indonesia	105
Russia	100
Vietnam	97
United Kingdom	96
Malaysia	95
Education	89
United Nations	83
United States	81
Opposition	79

FIG. 8A. *Most frequently used keywords*

51–60 ×	
Independence	60
Aden	57
America	56
Egypt	56
India	56
Trade	56
Oil	55
Economics	55
British	55
University	53
U.K.	53
Sanctions	53
Mortgages	52

61–75 ×	
Elections	75
Communism	74
Legislation	74
Finance	74
Economy	71
War	71
Universities	68
South Africa	66
Policy	63
Asia	62
Singapore	61
Taxation	61

FIG. 8B. *Most frequently used keywords*

Fig. 8B shows the further move towards topical items as one moves down the frequency scale, and it is already possible to get some feel of a few of the major topics that moved the political world in the second quarter of 1966. To get more specific information, however, one has to move further down the scale to much lower frequencies, e.g. Billy Graham (fifteen), capital gains (eighteen), charities (forty-two), criminal appeal bill (nineteen), etc.

It should be of considerable interest to study relationships (synonymity, generics, etc) between the terms used; this is rendered feasible via the composite print-outs we have of all the terms used for each specific document.

2 The master file of alphabetically arranged keywords makes it a fairly simple matter to apply one particular criterion for indexer performance, i.e. the frequency with which he uses 'unique keywords'.

Unique keywords we have called those keywords which an indexer has used once only and which he does not share with other indexers. One might hold that an indexer should preferably use a terminology common to those interested in the subject field concerned, moreover, if his indexing system is to be an efficient one he should minimize the use of terms which relate to one document only. Hence, one might postulate that frequency of unique keywords should be negatively correlated with indexer proficiency. In order to test this, we counted in the master file all terms with a single entry of the keyword number and totalled them according to the indexer code number listed with each keyword. The results are listed in fig. 9 in col. 2. It is obviously necessary to correct the values obtained for the number of documents indexed (col. 3), hence in col. 4 we have given the number of unique keywords per indexer per one hundred documents indexed. This figure can be somewhat misleading in those cases where the indexer did abort his indexing effort well before the end of the indexing phase as the proportion of unique keywords tends obviously to be higher at the beginning of the indexing phase than at the end. Nevertheless, examination of the data suggest that in our present case this effect is not significant enough to be of serious consequence.

The total number of unique keywords appears to be 3,111, i.e. 56 per cent of all different keywords (5,566) and *ca.* 1½ per document indexed. Hence the remaining different keywords were on average used $\frac{21{,}745-3{,}111}{5{,}566-3{,}111} = 7\frac{1}{2}$ times.

An interesting result emerges when one plots indexer codes against frequency of unique keyword use. This has been done in fig. 10. The code numbers for CIG members have been circled. It will be seen that whereas the overall distribution is reasonably symmetrical around a geometric mean of *ca.* 130 the CIG members are grouped around a mean of *ca.* 70, whereas the geometric mean for the non-CIG members is around 220.

Our finding appears to confirm that we may have in the unique keyword count a fairly sensitive indicator of indexer proficiency as far as co-ordinate indexing is concerned, this conclusion is reinforced by the fact that prominent indexers of known expertise in this field tend to be located in fig. 10 in the lowest frequency ranges. The attraction of this parameter is that it can be

Indexer No.	UKW Total	No. of doc.	UKW per 100 doc.
1	12	29	41½
2	13	77	17
3	117	74	158
4	33	77	43
5	30	77	39
6	75	77	97½
7	53	77	69
8	40	77	52
9	9	11	82
10	16	77	21
11	50	77	65
12	46	77	60
13	52	77	67½
14	19	77	25
15	36	77	47
16	36	77	47
17	9	6	150
18	185	77	240
19	45	77	58½
20	105	77	136
21	211	29	730
22	1	-	-
23	35	29	120
24	20	23	87
25	192	35	550
26	82	17	482
27	10	29	34½
28	33	29	114
29	46	18	255
30	48	42	114
31	20	12	167
32	51	23	221
33	17	29	59
34	48	77	62½
35	22	6	367
36	67	29	231
37	55	23	240
38	100	23	435
39	91	35	260
40	110	35	315
41	181	77	235
42	98	29	338
43	198	26	762
44	72	35	205
45	223	29	770
46	48	12	400
47	42	12	350
Total	3102		

FIG. 9. *Number and frequency of use of keywords per indexer.*

	Indexers	
Unique keywords per 100 doc.	Total	Code number
17 - 32	3	② ⑩ ⑭
33 - 64	11	① ④ ⑤ ⑧ ⑫ ⑮ ⑯ ⑲ 27 33 ㉞
65 -128	9	⑥ ⑦ ⑨ ⑪ ⑬ 23 24 28 30
129 -256	11	③ ⑰ ⑱ ⑳ 29 31 32 36 37 ㊶ 44
257 -512	8	26 35 38 39 40 42 46 47
512 -1024	4	21 25 43 45

○ = CIG member

FIG. 10. *Frequency distribution of unique keywords.*

arrived at by purely mechanical analysis of the indexer output. Our finding will, of course, have to be confirmed by further analyses and tests, but if substantiated it would seem worth while considering its use in co-ordinate indexing courses.

3 One could obviously follow the reverse approach from the one outlined above and assess the extent to which indexers are associated with frequently used keywords.

This approach is rather more involved and as yet we have not been able to explore it.

4 A further characteristic that seemed worth exploring is the rate with which the indexer increases his vocabulary of terms as he progresses with indexing.

On the basis of earlier work, it was felt that the following relationship might have some validity:

$$C = a.D^n$$

in which C = size of vocabulary
D = number of documents indexed
a = a constant, equal to or approaching the average number of keywords assigned to a document
n = a constant usually in the range 0.5 to 0.8, indicating the rate of growth of the vocabulary relative to that of the document collection.

The use of this type of relationship has been discussed fairly fully by G. Herdan*.

It was hoped that application of this relationship would provide us with a useful parameter n which would be again negatively correlated with indexer proficiency. This on basis of the assumption that the more proficient the indexer, the smaller his vocabulary is likely to be.

However, the preliminary results with computer analysis were rather less than satisfactory; this was in part due to the small size of the collection (seventy-odd documents) and partly to the fact that randomization is really required to handle such a logarithmic function satisfactorily.

We therefore decided to limit ourselves *pro tem* to the production for each indexer of a graphic plot of vocabulary size against documents indexed. This again was done via the computer using a plotting program which can be operated with a line-printer as output device. Fig. 11 gives an example of such a plot relating to indexer seven. If the above-mentioned relationship holds the corresponding log-log plot should give a straight line. Fig. 12 gives such a computer-produced plot again for indexer seven.

The main point here is to show that the above equation appears to fit the data reasonably well. Mr Boyd (indexer no.10) has also been plotting his data and has reported a satisfactory match between his actual data and those derived according to the relationship suggested above. It reinforces the view that it may be worthwhile exploring the usefulness of relationships of this type further; all we have been able to do so far is to carry out a few exploratory exercises. With the present set of data, however, it would probably be desirable to omit

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* G. HERDAN *Type-token mathematics*, The Hague, 1960.

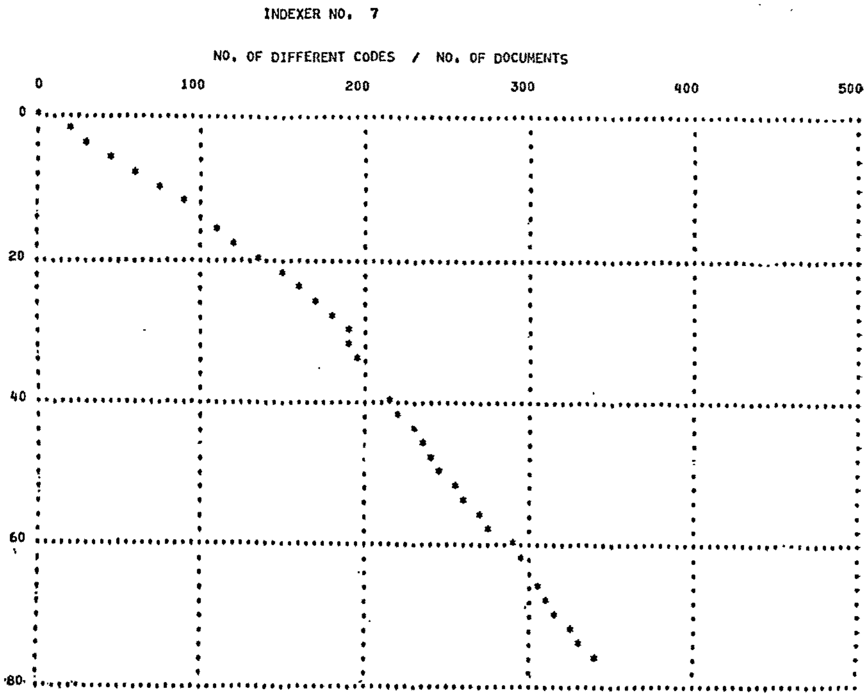
INDEXER NO. 7
NO. OF DIFFERENT CODES / NO. OF DOCUMENTS
0
100
200
300
400
500
0
20
40
60
80

FIG. 11.

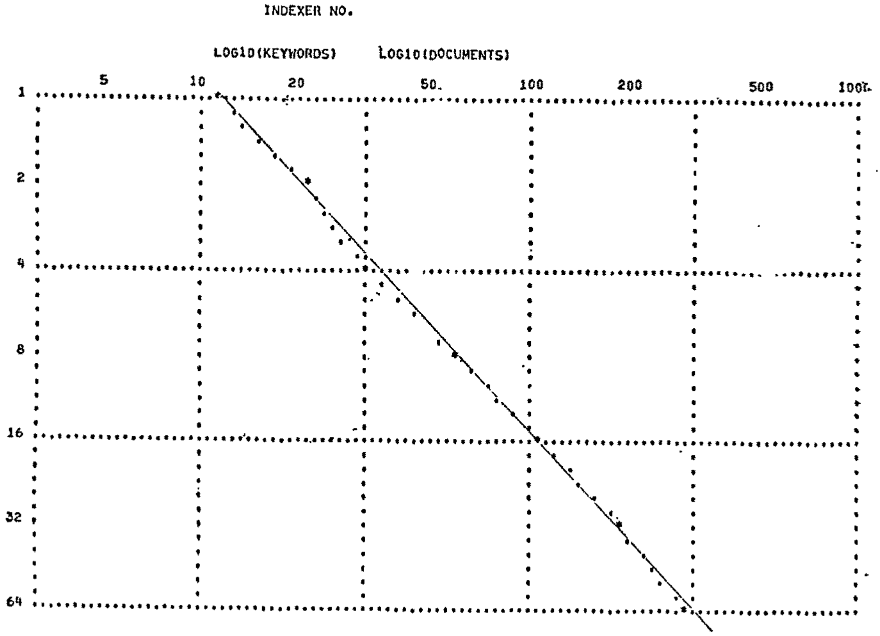
INDEXER NO.
LOG10(KEYWORDS)
LOG10(DOCUMENTS)
5
10
20
50.
100
200
500
1000
1
2
4
8
16
32
64

FIG. 12.

data on document one to ten or sixteen because indexer behaviour did change.

It should be pointed out that the above relationship is not likely to apply when there is a very strict control on the vocabulary.

5 As already indicated, further work on the present set of data will be required to provide more supporting evidence, but for the moment we will assume that it is justified to use the relationship $C = aD^n$.

Preliminary results appear to indicate that for the documents used in this project the value of n tends to be high, as might be expected for such a heterogeneous collection. In fact, it is likely to range from 0·8 to 0·95. Taking the values associated with obviously proficient indexers such as no. 2 ($n = 0{\cdot}80$) and no. 10 ($n = 0{\cdot}82$), one seems justified in selecting a value not exceeding 0·85 as indicative of a desirable keyword collection. The average number of keywords used per document ranged widely from four to *ca.* 25, with an average of ten. Here again we take a value of the order of six to eight, the value likely to be achieved in a well-operated system.

One thus would arrive at a desirable vocabulary size of around three hundred. It seems obvious to obtain this vocabulary from the list of most frequently used terms. In view of this, the distribution of the different keywords, 5,566 in all, according to use frequency was established. A summary of the results obtained in this computer run is given in fig. 13. It appears from this tabulation that if one wants to collect three hundred of the most used terms one should probably cut off below those terms which are used at least fourteen or fifteen times. In order to establish the cut-off point more closely we prepared also a print-out of the most frequently used terms down to a use frequency of seven. This involved 709 terms and these were printed out according to decreasing use frequency and also separately in strict alphabetical order.

Use of frequency range	*Number of keywords in range*	*cumulative*
256–129	4	4
128– 65	18	22
64– 33	53	75
32– 17	164	239
16– 9	304	543
8– 5	467	1010
4– 3	700	1710
2	745	2455
1	3111	5566

FIG. 13.

A graphical representation for the use frequency distribution is given in fig. 14. For various reasons this has been given as a log-log plot (frequency *v.* cumulative term totals starting at highest frequency) rather than as the perhaps more common log frequency *v.* probability plot. The distribution shown, and this was already apparent from fig. 13, is not a regular one; instead the graph in fig. 14 appears to contain two essentially straight line sections meeting at a cumulative term total of 320 and use frequency fourteen. It is interesting to note that the number of terms at the point of intersection is very close to that indicated earlier for a desirable vocabulary size. Whether this is more than a coincidence has yet to be established. Even so it appears an additional reason for selecting the terms with use frequency of fourteen and over as a basis for the final vocabulary.

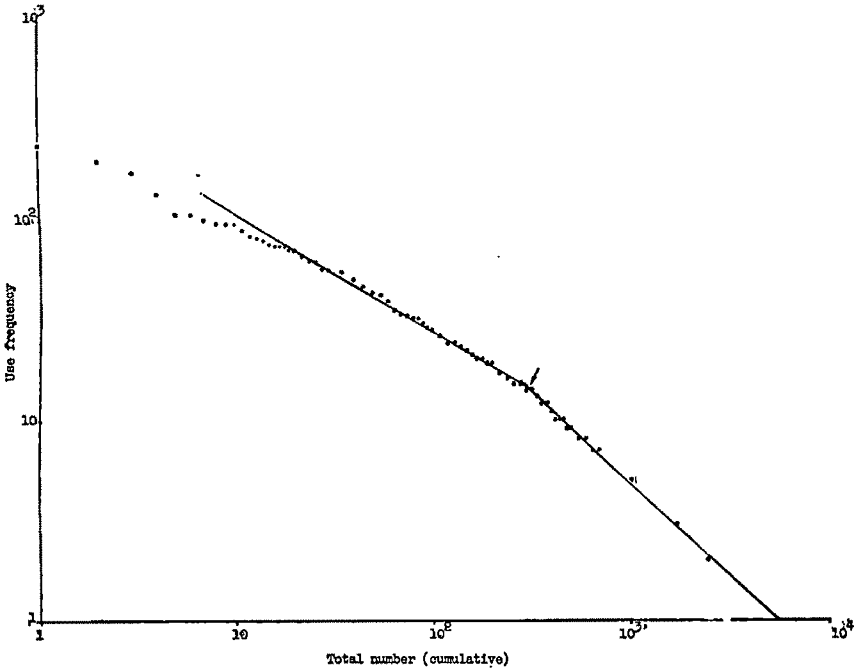

FIG. 14. *Use frequency vs. number of terms.*

Further tests will have to reveal whether the vocabulary thus obtained is an efficient one. This could be done by splitting it up according to document and checking whether this provides an adequate number of indexing terms for each document. Also obvious synonyms will have to be merged.

Spot checks appear to indicate that for indexers such as no. 2 and no. 10 about 70 per cent of their vocabulary are likely to be contained in the list of terms used fourteen times or more. In the majority of cases the words not included seem to differ from those present in the selected term list only in a trivial sense, e.g. a plural was used instead of a singular or vice versa. The impression therefore was gained that terms already present in the selected list might be able to take over the function of terms rejected in the lists of individual indexers. However, this needs to be investigated further.

Further Evaluation Work

It will be apparent from the above that the data collected in the Aslib CIG Research Project warrant a much more extensive evaluation than has been possible so far. First and foremost it will be necessary to establish the usefulness of the high-frequency terms list as a vocabulary by splitting it up according to document and checking against document content. In addition, obvious synonyms will have to be eliminated.

The study should be extended to include an assessment of the effect of:

(*a*) truncation of terms, use of word stems
(*b*) variation of the size of the vocabulary, e.g. inclusion of lower use frequency terms
(*c*) use of association procedures to deal with synonyms, generic relationships.

Furthermore, the following points seem worth studying:

(*a*) To what extent are textwords as such or in slightly modified form (e.g. as stem) present in the final vocabulary and how does this vary for the different types of indexers?
(*b*) To what extent are indexers associated with the keywords in the final vocabulary and can their performance be rated accordingly?
(*c*) How does term selection by the individual indexers vary with their experience and background?

The above suggestions point at only a few of the many interesting avenues for further exploration which are still open to us.

Conclusions and Outlook

The field investigated in the present phase of the project, i.e. indexer performance, is one which as yet has been very little explored.

The attraction of the CIG Research Project is that it enables a comparison to be made of the behaviour of professional indexers and those less committed to the art. The results obtained suggest that it may be quite feasible to develop some objective measures for indexer proficiency. In addition, it seems possible to develop objective procedures for the construction of authority lists/vocabularies from individual word lists. In essence, such procedures are likely to be based on relatively simple statistical manipulation of the keyword collections.

The data base created via the CIG Research Project provides a valuable foundation for further studies, so much so that as yet it does not seem warranted to undertake further collective indexing work; rather we should proceed with a more exhaustive study of the data already available.

It is hoped to undertake this via CIG working groups in consultation with Aslib Research Department.

Letter to the Editor

Dear Sir,

The article by Abbott, Hunter and Simkins (*Aslib Proceedings* 20, 129, 1968) describes an exercise of great interest. Comparison tests of this kind provide valuable information for scientists or technologists who may wish to participate in an SDI system.

It may be of interest to emphasize that the *ASCA* results shown in the tables were arrived at after using only one category of the many possible 'profile' questions which may be used in this system. Subject to the limitation that it is a 'words-in-title' test, the *ASCA-CT* comparison is a valuable experiment.

However, it may be surmized that had other categories of *ASCA* profile questions been used, the *ASCA* results would have been improved.

I refer to 'cited article', 'cited author', 'source author' questions, and other questions of this kind. 'Floating word stem' questions can now also be used, but were not available at the time of the tests.

For instance, it is stated (page 135) that in another subject field the relevance and interest of articles retrieved through 'cited articles' in the *ASCA* system was very high; seventy-five out of 104 references found were passed on to the research department, presumably because they were of interest—a truly remarkable result.

It must be pointed out that no *ASCA* results of this kind are given in the tables, because no 'cited article' questions were used in these particular tests.

In Table 6, the use of 'floating word stem' questions would of course retrieve the eleven articles mentioned, thereby reducing the articles missed through *ASCA* by nearly 50 per cent.

I fully endorse the remarks made (page 136) about the importance of personal contact in information work, and have no doubt that the help and advice received during the *CT-CBAC* tests made all the difference. However, I must hasten to add that the absence of any comments about co-operation with respect to the *ASCA* system does not mean that such co-operation is unavailable.

Again we can only surmize about improvements in the *ASCA* results when such co-operation is sought.

In practice this co-operation often takes the form of actually writing the profile for a subscriber, monitoring results on his behalf, and suggesting modifications to the profile.

Tests have already been carried out in widely different subject areas (to be published). These tend to confirm the view that profiles embodying 'citation article' questions used in conjunction with 'words-in-title' and other questions, can retrieve much more information of interest than through titles alone.

In the subject 'Holography' two 'cited article' questions retrieved a high proportion of the 1967 articles on that subject.

In the case of the subject 'Design and function of electromagnetic blood flow meters' five 'cited author' questions, used in an *ASCA* profile, would retrieve 90 per cent of the known articles published in 1967 about that subject.

Yours faithfully,

A. E. CAWKELL.

88 High Street,
Uxbridge,
Middlesex.
26th January 1968.

SELECTIONS FROM THE RECENT LITERATURE

ALL ITEMS listed may be borrowed from the Aslib Library, except those marked *, which may be consulted in the Library.

Books and Pamphlets

*AMERICAN BOOK TRADE DIRECTORY
18th ed. 1967–8. New York and London, Bowker, 1967. 828 p.

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Guides to newer educational media, by Margaret I. Rufsvold and Carolyn Guss. Chicago, A.L.A., 1967. vi, 62 p. $1.50.

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MEMBERS' ADVERTISEMENTS

Acceptance of advertisements for publication in Proceedings *does not imply Aslib support for or endorsement of the goods or services advertised.*

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AUTHORITATIVE TECHNICAL TRANSLATIONS from French, German, and Dutch into English and from English, French and German into Dutch, specialities electronics, optics, instruments, photography, API Ltd, director K. S. Ankersmit, FIL (French, German, English), 19 Godstone Road, Purley, Surrey. BYWood 3781.

TECHNICAL SWEDISH, DANISH, NORWEGIAN translated by J. T. Craddock, B COM, FIL, Ekard, Ray Park Avenue, Maidenhead, Berks. Maidenhead 24931.

WILFRED E. GOODAY, ARSM, DIC, MIMM, FIL. Member of Translators' Guild, Romanian and French. 161 Rivermead Court, London SW6. RENown 1912.

TECHNICAL TRANSLATIONS from Russian, German and Polish into English. B. Klipstein, B SC(HONS). 1 Glenview Grove, Shipley, Yorkshire. Tel. Shipley 58215.

TECHNICAL AND COMMERCIAL translations from English into Russian. Mrs O. Linsley, 31 Parke Road, Barnes, London SW13. Tel. 01-748 8822.

TRANSLATIONS FROM TURKISH. All subjects. F. P. Scott, 4 Uphill Grove, Mill Hill, London NW7.

TRANSLATIONS: TECHNICAL, SCIENTIFIC, all west-European languages. J. Smuts, B SC (ENGINEERING), FIL, 12 Thorndene Avenue, London N11. 01-360 7723.

TECHNICAL OR COMMERCIAL translations into/from English, German, Dutch and French. A. M. H. Speller, FIL, NGV, 6 Lakeside, West Ealing, London W13. Tel. 01-998 1045.

TECHNICAL TRANSLATIONS. Spanish, French, German. Typescript, camera copy, direct image plates. E. W. Sykes, FIL, 39 West Close, Wembley Park, Middlesex. ARNold 4273.

GERMAN/ENGLISH Translations. Commercial or technical, speciality ceramics, immediate service. Margret Young, FIL, 9 Osborne Road, Enfield. HOWard 4366.

Journals

Numerous scientific and technical publications including *Encyclopaedic Dictionary of Physics, Microelectronics, Semi Conductor Statistics* etc. Details of these and others available from Box 268 Aslib.

Patents Annual Name Indexes required by Mewburn Ellis & Co, 70 Chancery Lane, London WC2. (F.H.)

Offered, free: *Science Abs. A.* 1946–64; *I. Mech. E. Proc.* 1934–38; *I. Mech. E. J. & Proc.* 1939–53 imp.; *I.E.E. J.* 1932–48 imp.; *Nickel Bulletin* 1961–67; *Electronic Engg.* 1959; *J. Industrial Nurses* 1949–62, mostly bound—Librarian, W. D. & H. O. Wills, Bristol 3.

Translators

TRANSLATORS IN THE MEDICAL/BIOCHEMICAL FIELD, from French or Russian. Mrs Sheila Silcock, B SC would like to make informal contact with other TTG/Aslib members in this sphere. Would anyone interested please write or telephone, 3 Branch Hill, Hampstead, London NW3. Tel. 01-794 6224.

ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 May 1968 **Number 5**

ASLIB CALENDAR 1968

May

TUE.28.	Engineering Group evening meeting.

June

TUE.4.	Economics Group visit to *Financial Times.*
WED.12.	Aslib Annual General Meeting, London.
FRI.21.	Technical Translation Group visit to Shell Centre.
FRI.21 – SUN.23.	Electronics Group conference at Berkhamsted.
THU.27.	Transport Group visit to Cement and Concrete Association.

July

WED.3 – FRI.5.	Aslib course: Dissemination of Information.

September

SUN.22 – WED.25.	42nd Aslib Annual Conference at Canterbury.

October

THU.10.	One-day conference: Engineering Information Services.

MEDLARS Liaison Officers

OSTI is supporting the appointment of up to five MEDLARS liaison officers, who will receive a full training in the techniques of search formulation. Each will be responsible for one part of the country, will promote knowledge of MEDLARS by lectures and demonstrations and will personally help users to formulate their search profiles. It is expected that personal contact of this kind will make it much easier to formulate profiles accurately and that the profiles will then need only a minimum of further editing at the National Lending Library, so that the load on search editors there will be lightened.

Miss Marjorie King has been acting as a liaison officer in Newcastle for the last two years and will now cover the area of the Newcastle Regional Hospital Board, which stretches from Carlisle to the Tees. Mr Glyn Evans, based on the Royal Society of Medicine, has been trained to serve as a liaison officer for the South East and also for members of the Society. A post of liaison officer for Scotland, based on the University of Edinburgh, is currently advertised, and it is hoped that two further officers will be appointed later to cover the rest of Great Britain.

Degree Courses in Librarianship and Information Work

Three new courses, each with a different structure and leading to first degrees in librarianship and information work, are due to start in the autumn of 1968:

1. *The College of Librarianship Wales*, in conjunction with the University College of Wales, Aberystwyth, is offering a three-year course leading to the University of Wales degree of Bachelor of Librarianship. It combines the study of librarianship to joint honours level with the parallel study of an academic subject, chosen from those available in the arts and science faculties of the University College. The qualification for entry to the course is University of Wales matriculation and applications should be sent to the Registrar, College of Librarianship Wales, Aberystwyth.

2. *The Department of Librarianship of the Newcastle College of Commerce*, in conjunction with the Rutherford College of Technology, is offering a course leading to a CNAA (Council for National Academic Awards) BSc degree in information science. It combines information science studies with science and engineering subjects and is a four-year sandwich course in which the third year is spent working in industrial libraries and information departments.

Applicants for the course should possess GCE 'O' level passes in mathematics, physics or chemistry or chemistry with physics, and a language other than English, and two GCE 'A' level passes. Applications should be sent to the Director of Studies, Degree in Information Science, College of Commerce, Department of Librarianship, Education Precinct, St Mary's Place, Newcastle upon Tyne NE1 8SP.

3. *The Loughborough University of Technology*, in conjunction with the Loughborough Technical College, is offering a four-year honours course in library studies which may lead to either the BSc or the BA degree of the university. The course consists of three parts library studies, three parts associated subject studies based on courses already existing in the university and one part modern languages. Students will spend a total of twelve months working in libraries.

Applicants should have the usual qualifications for university entrance plus GCE 'O' level mathematics and at least one foreign language, preferably at GCE 'A' level. They should send applications to the Senior Assistant Registrar, University of Technology, Loughborough, Leicestershire.

Electronics Group Conference

The annual conference of the Electronics Group will be held again at Ashridge Management College, near Berkhamsted, from Friday 21st to Sunday 23rd June. Those who have been to earlier conferences will know that they are stimulating occasions in most pleasant surroundings, and every effort is made to ensure that this tenth conference, marking a decade in the life of the Group, is as good as or even better than those in the past.

The programme will open on the Friday evening with a talk by the Director, and on Saturday morning Mr Wright, Librarian of the IEE and the first Chairman of the Group, will review the past decade from the point of view of an electronics librarian. Other library topics include papers on an electronic materials information centre by Miss Royle of RRE, information retrieval by Mr Vaswani of NPL, and control of periodicals at the NPL by Mrs White, the Librarian. Recent technical developments in the electronics field will be described by Mr Hart of BTR, who will speak on fluidics, and by Mr Hornby of ATE, Ltd, who will speak on modern developments in traffic control.

The conference fee remains at £9 inclusive. The full programme and application form, which will be sent to all Group members, may be obtained from Mr J. E. Wright, The Library, Institution of Electrical Engineers, Savoy Place, London WC2.

Royal Society Fellowships

A welcome recognition of the importance of scientific information work is indicated in the creation by the Royal Society of two Scientific Information Research Fellowships, tenable at any place approved by the Council of the Society, for research in the general field of scientific information. The fellowships fall into the category of the Society's research fellowships that is intended for younger persons, and they will be subject to the conditions governing Royal Society research appointments. They will be renewed annually for such periods as the Council of the Royal Society may determine.

Further details and application forms are available from the Executive Secretary, The Royal Society, 6 Carlton House Terrace, London SW1. The closing date for applications is 31st May 1968.

Industrial Training

A Training Abstracts Service was launched by the Ministry of Labour in January 1968 to cover the rapidly growing literature on training and associated subjects and cater for the information requirements of training officers, training specialists of all kinds, the industrial training boards and research workers in the behavioural sciences.

The service will provide about eighty abstracts a month, printed on 6 × 4 inch cards, for a subscription of £5 10*s* a year. No attempt will be made to abstract material available elsewhere in a suitably summarized form, but abstracts from about a dozen such sources, which may otherwise escape attention, will be correlated and reissued in conjunction with material abstracted by Ministry of Labour staff. A special classification of training information, based on an analysis of the training function, has been developed in consultation with a number of people in industry and in academic life.

Further details of the classification employed and copies of a leaflet describing the service are available from Mr G. Huggins, Training Department TD.2, Ministry of Labour, 168 Regent Street, London W1.

Use of NCL Union Catalogues for Research Workers

The union catalogues of the National Central Library, although primarily intended as finding lists in connection with inter-library loan requests, may on occasions prove an aid to research workers requiring locations or wishing to know the availability of a number of works, possibly including the several editions of such works.

If the information required concerns only one or two titles, it may be better to inquire by letter or telephone; otherwise a personal search with the advice of the NCL staff may be desirable.

Research workers wishing to make such an extended search must first make their requirements known to their librarian, who will inform the NCL of the nature of their work and arrange a convenient time to visit. In general this will be afternoons, Monday to Friday, rather than mornings.

Aslib/ECMRA Joint Conference

The Aslib Chemical Group and the European Chemical Market Research Association are to organize a one-day Conference at Quaglino's, Bury Street, London SW1, on Tuesday 12th November 1968.

The Conference will take the form of a study of information sources and how they can best be exploited in Market Research Work. A series of short papers will be given by experts well acquainted with the problems of locating sources of unpublished information. It is intended that delegates will take an active part through their contribution to the discussion periods, which will be developed on 'open forum' lines.

A further announcement will be made shortly giving more detailed information about the conference programme and registration.

Dr J. G. Pearce

Dr Pearce, a founder and for many years an honorary member of Aslib, has recently been elected Master of the Worshipful Company of Founders. Dr Pearce was formerly Director of the British Cast Iron Research Association.

NEW MEMBERS

Name	*Locality*	*Representative*
Atomic Energy of Canada	Canada	Miss J. Reavley
J. D. Bernal Peace Library	London	Dr I. Kenrick
British Oxygen Co Ltd	London	Mrs J. Stoddard
Catalytic International Inc	London	Mrs M. C. Rita
Direct Mail Consultants (Cambridge) Ltd	Cambridge	Mrs M. E. Knowles
Dornier GMBH	Germany	Miss F. Hecht
Edinburgh College of Commerce	Edinburgh	Miss A. S. Cowper
Electronic Machine Co Ltd	Surrey	J. H. C. Sykes
Engineering Industry Training Board	London	Miss B. E. Goulding
Glacier Metal Co Ltd	Middlesex	Mrs D. L. Oldfield
Hamlyn Group	Middlesex	Miss R. J. Nell
Indata Ltd	London	D. H. Barlow
Intermediate Technology Development Group Ltd	London	G. McRobie
International Data Highways Ltd	London	Miss H. M. Townley
Laurentian University	Canada	Mrs C. Falkenberg
Libyan University	Libya	Abd. El Hamid El Tayyar
Life Offices' Association and Associated Scottish Life Offices	London	R. G. Renton
National Aeronautical Laboratory	India	M. N. Seetharaman
Norton, Rose, Botterell & Roche	London	Miss J. M. Ferguson
Royal College of Art	London	H. Brill
Royal College of Veterinary Surgeons	London	Miss B. Horder
Sait Electronics	Belgium	Madame M. van Oudenhore
Skelmersdale Development Corporation	Lancashire	B. M. Burke
Turners Asbestos Cement Co Ltd	Manchester	D. A. Baker

Individuals	
Aiyubi, M. H.	London
Allen, D. L.	Leicester
Cameron, J.	Glasgow
Carnell, M. J.	London
Corrigan, P. R. D.	Cardiganshire
James, P. M.	Caernarvonshire
Kaye, D.	Manchester
Koskiala, Mrs S.	U.S.A.
Mills, P. R.	Leeds
Oakland, Dr R.	Yorkshire
Stanford, G. H.	London
Willson, Mrs B. K.	Warwickshire

THE DUALITY OF THE CHEMIST'S LANGUAGE

W. E. BATTEN
Head, Central Technical Information Unit, ICI

Paper presented at a meeting of the Aslib Chemical Group, Wednesday 6th March 1968

THE chemist enjoys a richness of means of expression that is not to be found in all activities. When I say 'enjoys', of course, I do not imply that nature has been copiously generous and bountiful; the semantics of chemistry are as much a tribute to succeeding generations of chemists as is the theory and practice of the subject itself. To a great extent, I suppose, the nature of the subject demanded an exceedingly informative and definitive language, and progress would have been the slower without it. But few other activities, it seems to me, have been at such conscious and scholarly pains to provide and to cherish both vocabularies and notations for the recording and exposition of their aims and achievements. Musicians and mathematicians, for example, have both evolved highly specialized notations for the embodiment of their creative thought. Both notations are highly informative—in the Shannon sense; i.e. they are packed full of information and have very little redundancy. But neither vocation, it seems to me, is satisfactorily articulate in ordinary language; they are in much the same difficulty as the wine merchant, whose English can perhaps be enjoyed for its quaint whimsiness but not for its ability to convey a useful description to the palate.

This rich and abundant language that chemists have created has been, of course, an evolutionary product, distilled, rectified and crystallized over a long period—reflecting changing theory, increasing knowledge, and shifting emphasis. In the main, however, it is a product of the pen and ink era, and has made no special inclination towards the impending incursion of punched cardery and electronic data processing. In the formative years of language development it could scarcely be foreseen that the bookworm would have to become a tapeworm! But this is the metamorphosis that is upon us, and it will be important to ensure that the strength and precision of our language are fully preserved, and wholly deployed, in whatever electronic forms our literature may take. The reading mind is an infinitely flexible and responsive organism; in computer terminology, it needs no prescribed program: it programs as it goes. It is not actively conscious in its reading decisions whether it is dealing with language or with notation, or with data; it will switch from one to the other very rapidly in making its selections and rejections of what is relevant and what not.

But in the brave new world of electronic documentation we shall have to be at some pains to distinguish between language and notation. Language records thought that is not necessarily precise and definitive. Only in the hands of lawyers does language acquire the property of sharp inclusion and exclusion—

and not always then! It is fundamental that very few words possess sharp boundaries, and even a chemical 'statement' leaves room for doubt as to its implicit, if not as to its explicit, content. What is true of 'words' is even truer of phrases and sentences. But notations are free of all such poetic nuances. There is no dubiety about the notational statement that a chlorine atom is attached to a carbon atom; the statement is either right or wrong. To this extent, the knowledge that can be embodied in notational expressions partakes of the nature of data rather than of information. This difference in nature between the two informational components must lead to apparently different semantic and programming treatments. It is, perhaps, too soon to discern whether—in the sense of information science—these differences are real or merely symptomatic.

I am not at all sure that the literature of information science will permit me to use the terms 'information' and 'data' to distinguish the two types of intellectual matter that I am trying to talk about. Too often, the words seem to be used interchangeably or either is used generically to include the other. However, for our own purposes today, I will say that 'knowledge' is composed of (imprecise) information and of (precise) data, and leave it at that.

Now, as we all know but do not like to admit, we do not yet have automated information retrieval systems. We cannot retrieve information: only little packets of references that might contain the desired information. And so long as we deal in words, I think it may always be so—but write me off as the pessimist that I am! But automatic *data* retrieval is, of course, another kettle of fish.

Data are entirely organizable, provided that there is sufficient demand to justify the cost of doing it. In at least one large area of chemical data—molecular architecture—it seems clear that the demand *is* there, and that the cost will be met. I sometimes wonder, however, whether the majority of working chemists (who, goodness knows, are busy people, and have their own preoccupations) have been sufficiently told of what computerized molecular architecture can, in due course, do for them and to what extent it is and is not a contributor to the overall chemical communications problem.

At the risk of some tedium, I will inject a few nauseating platitudes—just in case there may be one or two who have only just joined the programme. When you index a document (or its abstract) you are in fact seeking to give that document properties by which it may be recognized, and distinguished from vaguely similar documents. In this sense, you are adding certain subjective attributes to its intrinsic physical attributes (size, colour, author, date and so forth) and thereby (hopefully) giving it the potentiality to respond to a variety of stated subject-matter requirements. Even if you use so-called 'free-text', rather than indexing, you are doing the same thing. Amongst the descriptive attributes that you attach to it there may well be one or more names of chemicals. But you are using these names as attributes of the document, just as surely as when you add the term 'oxidation', or 'nitration', etc. The document remains 'the item'; the chemical name remains the 'descriptor'. You can never be wholly successful in this activity. Your application of descriptors will be constrained by your imagination or by your budget—whichever be the smaller.

When, however, you turn to the creation of a register of chemicals (e.g. the CAS Registry System, or the proposed Index Chemicus Registry System) you are creating a totally different kind of matrix. You are no longer directly concerned with the document or documents in which the chemical is described. You are concerned to record the intrinsic attributes—the architectural attributes in this case—of the molecule, just as though they were descriptors of the molecule. Indeed they *are* descriptors of the molecule—but with the immense advantage that, unlike awarded verbal descriptors, they are absolute and real in their validity as descriptors, and each contributes equally to the representation and characterization of the molecule. Furthermore, these descriptors do, in total, *completely* characterize the compound in the architectural sense. So that, in a molecular registry system, the *molecule* is the item—the thing to be retrieved—and the molecular features are the descriptors by which it *is* retrieved.

How then should these two media interact so as to bring the greatest contribution to the overall retrieval of knowledge?

I will not digress this afternoon to speak of the immense potential that will exist in a file that confronts structural detail with behavioural detail. This I would prefer to leave to those more competent to do it full justice. If I need an excuse for omitting it, it is that I do not see it (save perhaps in its system development phase) as essentially a part of information science in the general sense. Rather, I think, such files will become powerful extensions to the minds of working chemists themselves, enabling them to probe for correlations that neither their eyes nor their sub-conscious thinking could otherwise encompass. They will not be then concerned with retrieval as such, but with the exposure of cause and effect relationships that are only dimly implicit within the data base. My own concern, however, is with the application of a registry file of structural features in the further improvement of our retrieval of documentary items.

The first thing that a structural registry system does is to establish the uniqueness of a compound. The same compound may come in four or five times, under different systematic names, and with its structural formula pointing N, S, E and W; but the grinding logic of the registry program will in due course establish their identity. Thus, *one* compound gets *one* registry number. And from then on, that substance can be known, unambiguously, by its registry number. This, alone, is of some assistance in ordinary retrieval. It does at least mean that one's working vocabulary or thesaurus need not be cluttered with both vinyl cyanide and acrylonitrile—123456 will do for both. In some cases, many more synonymous names will be avoided. Of course, somewhere in a book or on a magnetic file, one needs a way of arriving at registry numbers—but this will be a once for all operation. And those chemicals that are your daily concern will eventually become mere numbers, and will be so manipulated. A search will specify Compound No. 123456 without either the inquirer or the information officer even asking what the number means.

However, it is not so very frequently that a single isolated chemical forms a search term in a co-ordinate expression—save perhaps in some of the biochemical areas. More often there is an interest in a group of chemicals. Rarely, this group may be picked up by a known handle—or, if not precisely picked up, picked up with a few old boots and tin cans hanging on it or alternatively shedding some of its treasure as you haul it out of your muddy fishpond. Developments from a registry system will enable one to do better than this.

It will, I think, be apparent to anyone that *if* the registry file contains all atoms and all bonds for every registered molecule, then it is only a matter of programming (albeit fairly complex programming) to enable sub-collections or surrogates of molecules to be put together, in which all molecules possess certain stated configurations, e.g. $\equiv C{-}O{-}N{=}$. There is no theoretical limit on the simplicity or complexity of the configuration that may be demanded. So, then, in our literature index, in addition to having unique registry numbers as descriptors, we have the means of using class designations as well, with the immense advantage that the computer will have told us in advance the size and nature of the contents of the class. Of course, in our literature reference file we will be pragmatic about our choice of classes; we shall not insist upon acknowledging classes that do not have significance for our work—however significant they may be for other people. But as our needs change we shall always be able to add a new class by making one simple inquiry of the registry file.

There must clearly be anticipation on the part of the literature file organizer as to the support that he will need from the registry system. If this is not so, he will be constantly making small structural inquiries of the registry system and these will (1) be uneconomically costly and (2) introduce an unwelcome delay into his overall response performance. So that one can, I think, envisage the information officer maintaining, in consultation with his clients, a dynamic list of class terms, based wholly upon structural characteristics. These class terms will be descriptors within his thesaurus (if he has one) and will be the direct structural equivalent to the so-called 'Broader Terms' of the verbal section of his thesaurus. It will not be strictly necessary for him to find *names* for these structural class designations; he can evolve some convenient numbering system suited to the size of his own field of interest and simply maintain an explanatory catalogue of his chosen class terms, as a search aid. Nevertheless, despite this useful parochial way of using a registry system, we must, I believe, in the interests of improved communications, expect that one eventual development from an established registry system will be the generation of an internationally approved complex of structural class designations. Like UDC, it will not be able to provide, unambiguously, for the particularity of interest of every individual chemist. But it should be entirely capable of organizing a system of classes that will be widely valuable as thesaural descriptors.

It would then, I suggest, be an automatic part of the registration programs that a new compound, in addition to receiving a registry number, would be posted as belonging to certain of the 'International Chemical Class Numbers'. Such a procedure would be, as an act of information science, the direct semantic equivalent of the act of awarding thesaural descriptors on the basis of textual content with, of course, the important difference that, whereas the award of thesaural descriptors is a subjective, judgement-ridden, activity, the award of class terms would be an objective binary matter.

It is, perhaps, worth digressing for a moment just to say that there is nothing fundamentally new in my attempted glimpse into the future, and to relate it to what chemists have tried to do in the past when they were unconfused by the wizardry of *I*nterminable *B*inary *M*anipulation and *I*ncomprehensible *C*omputational Technology. In those happy, cosy days chemists thought up for themselves 'fragment indexes'—i.e. they composed a thesaurus of molecular fragments—suited to their own needs—and awarded these fragments to those molecules that interested them—by the well-known technique of intellectual inspection at non-intellectual rates of pay. Gradually, of course, the slave labour dragged its chemical masters, kicking and screaming, into the era of perforated cardboard, and fragment indexes made increasing use of the techniques of both Hollerith and Batten. The same approach could have been based on a line notation, e.g. Wiswesser—with the advantage that many fragments could have been automatically generated by Hollerith techniques—but this way of working seems not to have had any very wide appeal.

So the position has been that most fragment indexes of the past have been the product of intellectual examination and have, therefore, been inevitably parochial, limited and incompatible. The leap forward that a registry system offers is the automatic award of fragments that can be universally recognized and communicated without the need to overcome any language barrier. For perhaps the first time in the history of information science, one single analytical treatment of an item can generate a set of universally comprehensible and unquestionably valid attributes of that item. If so, it is a remarkable tribute to the continual care that the chemist has had for his notational linguistics.

Of course, there are inevitable flies in the semantic ointment. Ever since sordid commerce laid violent and defiling hands upon the fair, if voluptuous, body of science, there has come into being, as a somewhat discreditable product of this not wholly rapacious union, a good deal of bastard terminology. It justifies itself, of course, by the contemporary cult of brevity—a curious latter-day monster that appears equally at home in the service of either intellectual dignity or meretricious posturing. Nevertheless, it has bred terms such as oxo-alcohols, nitro bodies, plasticizer acids, and so forth, and one fears the possible birth of such mutations as the Ayrshire alginates or the Cheshire chelates or even the Carrington catalysts. This kind of language is clearly not going to get any assistance from the developments that I have been postulating. If such terms are of general usefulness to a large body of chemists, it is the duty of their midwives to provide an ancestry. If the definition can be expressed in wholly structural parameters, then an approved class could be recognized and we would merely have noted a new trivial name for a class that could have been designated logically by the registry system. But if the intention of the term is to convey functional or historical, or geographical characteristics that are independent of structural parameters, then the terms are no more than conventional thesaural entries that must be awarded by knowledgeable inspection, or picked up from the text.

Those last few words 'picked up from the text' bring me to the few remaining thoughts that I would like to leave with you this afternoon. I would like now to turn to the techniques of information science itself and away from their application to structural description which, you will recall, I class as data rather than information.

In the processing of textual information, we already face a very serious question; serious because the economics of our information services may depend upon the answer: serious because we do not have the material from which to construct a 'model' that might guide our answer. Clearly, there are two things that we can do with an abstract (assuming it to be a good abstract). Either we can stare at it, thesaurus in hand, and, with good intentions, label it. Some people can persuade themselves that they are very good at this; they are of the school that believes that an item is rarely, if ever, significant outside the context of its birth. They may, for all I know, be right—probabilistically, anyway. As I said earlier, I am a pessimist; so I believe that an item could conceivably have significance in almost any context. And I regret that the combined imaginations of the author and myself are unequal to the consequences of such open-mindedness. But, I am at least logical enough to recognize that my philosophy is in the extreme just as disastrous as that of the opposite school. The latter would be happy with a single UDC designation (provided it could be composed with confidence). I, however, would have to demand at least ten designations, and possibly an infinity.

Whichever school we belong to, if we are not satisfied to stare, thesaurus in hand, or think that we cannot afford to do so, we can as the alternative consign the whole abstract to the computer. Please note that word 'consign'; I chose it with mischievous care. In consigning to the computer we have not solved our problem; we have merely ducked it. Put rather brutally, we have said 'these abstracts do not deserve intellectual digestion—or, alternatively, the cost of digestion is too high; what nutritive value they possess must be extracted by the computer, which I know to be gastrically feeble, but which is cheaper'.

Surely, if we leave it at that we abdicate from our responsibilities, and dishonour our profession. For we know that the computer has neither palate nor stomach for anything beyond the mere plankton of information. It perceives nothing beyond symbols and spaces; is this all that the chemist, the scientist, writes? Are we going to build a compost heap out of smoked salmon and asparagus?

This brings us full circle to what I hinted at earlier: the difference yet similarity between the processing of structural *data* on the one hand and of descriptive *information* on the other. At present we cannot articulate to the computer all the considerations that affect us when we make the decision to post an item to a particular thesaural term. So we are not able so to instruct the computer that it will do to an abstract the exact processing equivalent of what I have foreseen its doing to a structure. And yet, in some way, we have to overcome this difficulty if we are to make anything more than a mnemonic scratch pad out of 'free-text' searching. Of course, if you are of the school that believes that the significance of a publication does not extend beyond the immediate environs of its nativity, you will not be concerned with what I see as being still the greatest challenge of information science. But if you share with me a taste for the greater difficulties that accompany the competitive viewpoint you will not be content with a so-called system that merely invites you to guess what words an author or abstract writer might have employed in presenting a theme that can, at best, only partially overlap your immediate interest. However, your very righteous discontent will have to be transmuted into constructive energy if you are to offer a viable alternative to the expedient and rather defeatist philosophy of pure free-text searching.

This is not to say that many of the devices of free-text operation will not find a place within a more sophisticated form of semantic analysis. Certainly the devices of truncation and decapitation are a way of capturing semantic variations on the basis of their purely notational similarities, and in that they are very appropriate to the particular perceptual talents of the computer they must be preserved and used in a constructive way. But, as we all now know, over-enthusiastic truncation is as productive of noise as is the over-enthusiastic use of omnibus thesaural descriptors. The selective power of co-ordination seems, disappointingly, to lose much of its force when applied within the confines of some particularized chapter of literature.

There remains with us the fundamental problem of finding within (or injecting into) our language the same precision that we have built into our notations. It will, of course, remain a fundamental problem for, even if we improve the linguistics of our own discipline, we can do little about the general language within which our own particular events must be discussed. For this reason, I find it hard to believe that any *wholly* automatic analysis of text can ever approach the perfection that is possible with notational data. Instead, it seems to me, we have to admit the necessity for intellectual intervention, but to organize our systems so that this intervention becomes a series of unique, creative, original actions and not a wearisome, repetitive prostitution of the intellect. How can this high ideal be approached?

My answer is a rather trite one. By taking the computer into one's confidence! If you make the decision that, *for you, within your system,* 'Alsatian' is a 'dog', you do not need to make that decision a second time—let alone take action on the decision. You can communicate the decision to the computer, with an instruction that whenever 'Alsatian' is met it counts as a reference to 'dog'. Thereafter, your thesaural decision will be looked up, and applied, whenever the term 'Alsatian' is encountered in free-text. More complex (yet articulate) thesaural decisions could be based upon word clusters that are closely adjacent within the text. None of this activity need destroy the specificity that is inherent in the free text itself. That is still there for deployment as required.

All of this has been done up to a point. But there is no reason at all why the thesaural rallying points need be limited to what has been preconceived by the system designers. If a program can be conceived and written that will accept and apply a perpetual stream of thesaural decisions, then I would foresee that there is real hope of marrying the speed of free-text input to the analytic sophistication of thesaural activation. Much of the thesaural treatment of text would automatically follow the mere putting of an abstract into the file. To the extent that the thesaural decision file failed to satisfy the program's semantic curiosity, questions could be posed by the computer to its masters. Its masters' answers would, when prepared and input, become a part of the ever-growing power of the thesaural decision file. In this way the structure or semantic architecture of the verbal notation would be gradually accumulated as a basis for the program's text analysis. The difference between such text analysis on the one hand and molecular analysis on the other is that the latter exists, so to speak, instantaneously and almost completely from the moment that the system is conceived. The former, however, cannot exist *completely* at any moment in time because language gets itself used in a variety of original ways—some highly informative and others frustratingly cryptic or obscure. So, the associations that are, so to speak, the unseen valency bonds of our verbal molecules must be left to expose themselves during a long and tedious and never completed strip-tease act.

There will, even then, always be one aspect of associative analysis that it seems to me will remain for ever unmechanizable—even on the basis of calling upon programmed analytical reflexes. These are the unique summarizations involved when an indexer adds (as in my view he should add) the appropriate abstract concepts that put the item into one or more of the philosophical areas of the collection's field. Thus, if a collection is concerned *inter alia* with the concept 'catalysis', then this term (or one of its truncations) should be added where needed even though it does not appear explicitly in the text. This is the leap that I cannot foresee the computer ever being taught to make. You could teach it all the named catalysts that ever were, and program it to add 'catalysis' every time it met such a name. But it would, of course, faithfully add 'catalysis' when the reference was only to tungsten steel or platinum electrodes.

Language and notation *are* fundamentally different linguistic forms. But in our processing of notational material we shall learn many tricks that can, with imagination, be applied to verbal material. Trickery, however, should never be overdone!

DISCUSSION

Dr Lewis (ICI) asked how Markush-type formulae could be applied to notational expressions.

Dr Batten replied that a Markush formula, being a form of shorthand for a large number of chemicals, should clearly be treated notationally rather than semantically. It could be given full significance only by 'translating' it into its list of possible members. However, it could, as such, be labelled with those 'structure class descriptors' that applied to it. This might save a certain amount of referring back to the basic registers.

Mr B. Stern (BIP) asked how the various international bodies could be forced into thinking in terms of the international class numbers envisaged by Dr Batten.

Dr Batten suggested that economics would eventually encourage the concept into being. Much trial and error would probably precede any universal series of classes.

Dr Batten then posed a question to the audience: 'If a molecular system is to formulate terms which will be useful as search terms in a thesaurally based document retrieval system, it will involve some programming effort and therefore some expenditure by the registry systems concerned. Could anyone offer any estimates of the relative frequency with which a chemical name, or a chemical class name, forms one of the search terms within a Boolean expression addressed to the chemical literature at large?'

Dr Simkins mentioned that in her experience co-ordination between classes rather than one specific compound or molecule was more usual.

Miss D. Dawson (RAPRA) stated that the nature of the inquiries received by RAPRA was reasonably equally divided between material and product. The materials were polymers or additives (specific names), not necessarily alone but in co-ordination with other parameters.

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ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 June 1968 Number 6

ASLIB CALENDAR 1968

June

TUE.25.	Transport Group visit to Cement and Concrete Association.

July

WED.3 – FRI.5.	Aslib course: Dissemination of Information.
TUE.16 – FRI.19.	Junior Introductory Course to Special Library and Information Work.

September

SUN.22 – WED.25.	42nd Aslib Annual Conference at Canterbury.

October

THU.10.	One-day conference: Engineering Information Services.

November

TUE.12.	Chemical Group Conference.

1969

April

TUE.15 – THU.17.	Chemical Group Conference.

Chemical Group

The Group intends to be active during 1968 to 1970 in the area of commercial information and has for the past year been assessing both the need for such activity and the interest of the membership.

It is felt that much commercial information is at present too scattered to be readily accessible, and that while technical information offers far fewer problems the urgent need expressed by firms is for commercial information. In this connection two conferences have been planned.

1. A joint one-day meeting with the European Chemical and Market Research Association (ECMRA) will be held on Tuesday 12th November at Quaglino's, Bury Street, SW1.

2. The Chemical Group 1969 residential conference will take place from 15th to 17th April 1969, at Loughborough University. In view of the importance of this subject area, members of ECMRA will be invited to participate, and it is anticipated that a considerable number of overseas members will attend. Applications from all Aslib members will be welcome.

A further announcement will be made shortly giving more detailed information about the conference programme and registration. Meanwhile the Group Secretary, Mr A. R. Dodd, Porous Plastics Limited, Dagenham Dock, Essex, will be pleased to receive the names and addresses of interested members (persons or organizations) who are not already on the Chemical Group mailing list.

Library Services in the New Polytechnics

It is proposed to hold a seminar on Library Services in the New Polytechnics from Monday 1st to Wednesday 3rd July 1968 at the Leeds College of Commerce. The intention is to provide a forum in which librarians in designated polytechnics might discuss common problems, anticipate similar difficulties to those experienced by the CATs in their transition to technological universities, and provide an opportunity for the discussion of specific problems (e.g. mechanization, service to users, etc.).

Outside speakers participating include Mr A. C. Bubb (University of Salford); Mr E. G. Baxter (Lanchester College of Technology); Dr A. J. Evans (Loughborough University of Technology); Mr J. Flint (Leeds Central Colleges); and others.

The course fee will be approximately £5 (excluding accommodation).

Full details will be available in the next few weeks and can be obtained from Mr D. Daintree, FLA, Department of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1.

Workshop on Library Survey Techniques

It is proposed to hold a Workshop on Library Survey Techniques at the Leeds College of Commerce, from Monday 16th to Friday 20th September 1968. This is intended for librarians interested in acquiring practical experience in the organization and interpretation of library surveys.

The course will be of a practical nature and will cover methods of conducting surveys, design of questionnaires, sampling, interviewing, processing and interpreting the results. As part of the course students will conduct a variety of surveys and analyse and interpret the data.

The course tutor will be Mr Harvey Sheldon of the National Institute of Adult Education, who will be assisted by Dr Woods (National Lending Library), Mr B. Luckham (University of Manchester) and Mrs M. Slater (Aslib).

The tuition fee will be approximately £7 (excluding accommodation).

Full details will be available within the next few weeks and these may be obtained from Mr D. Daintree, FLA, Department of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1.

Work on Librarianship in the Social Sciences

It is proposed to hold a Workshop on Librarianship in the Social Sciences at the Leeds College of Commerce from Monday 23rd to Friday 27th September 1968. This is intended for librarians in universities, colleges, public libraries, government departments, etc., who are familiar with the techniques of librarianship but who now wish to gain an understanding of the bibliography and librarianship of the social sciences.

The course will be of a practical nature and will include sessions on social science bibliography, library administrative problems, cataloguing, classification and indexing of social science material, mechanical information retrieval in the social sciences, etc. Staff of the Workshop will include Mr J. Fletcher (Economics Librarian, University of Warwick), Mr D. Holland and Dr D. Menhennet (Librarian and Deputy Librarian, House of Commons), Mr A. N. McGregor (OSTI), and others. There will also be a series of lectures on 'Current trends in the social sciences' to be given by Professor E. Grebenik and others from the Department of Social Studies, University of Leeds.

The tuition fee will be approximately £10 (excluding accommodation).

Full details will be available within the next few weeks and these may be obtained from: Mr D. Daintree, FLA, Department of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1.

Medical Librarianship

The Third International Congress of Medical Librarianship will be held in Amsterdam from Monday 5th to Friday 9th May 1969. Inquiries should be made to the office of the Secretary-General, 3rd International Conference of Medical Librarianship, Herengracht 119, Amsterdam, The Netherlands.

Parliamentary and Scientific Committee

The *Report on collection, dissemination, storage and retrieval of scientific and technological information* by the Parliamentary and Scientific Committee has now been published. Copies are available, price 4*s*, from the Secretary, 7 Buckingham Gate, London, SW1.

Bradford's Law of Scattering?

Aslib Library is anxious to increase the coverage of articles relevant to its interests but published in periodicals outside the documentation field. It is hoped to resume the co-operative reporting scheme formerly enjoyed, and the co-operation of members is invited.

Notification forms are available on which to send to Aslib details of current papers on information science and related topics, which have been published in periodicals not normally scanned by Aslib, and members willing to offer help in this way are requested to inform Mrs E. Mack, Head of Library and Information Services.

Courses in Librarianship and Information Work

West Ham College of Further Education is extending its range of courses to include part-time preparation for the Library Association Part II examination and the Library Assistant's Certificate of the City and Guilds of London Institute. These courses will begin in September 1968, by which time the College will occupy new premises at Welfare Road, Stratford, E.15. Intending students are asked to contact the College as soon as possible.

Further information may be obtained from the Course Tutor in Librarianship, Department of General Studies, West Ham College of Further Education, North Street, Plaistow, E13 (01-472 1259 or 5123).

British Museum appointments

By a coincidence, two people prominent in Aslib affairs have received mention in the news during the past month in connection with the same institution.

Sir John Wolfenden, Chairman of the University Grants Committee, formerly Vice-Chancellor of the University of Reading, and a Vice-President of Aslib, has been appointed Director and Principal Librarian of the British Museum in place of Sir Frank Francis, who retires in October.

Miss Maysie Webb, who became Keeper of the National Reference Library of Science and Invention in 1966 (see *Aslib Proceedings* June 1966, p. 151), has been appointed an Assistant Director of the Museum.

Aslib Services

Binders will shortly be available, price 9*s* 6*d*, designed to accommodate the series of leaflets on Aslib Services which are currently being enclosed with *Aslib Proceedings*.

Will anyone who wishes to obtain a binder please place an order through the Publications Department?

Review

WILCOX, DENNIS L. English Language newspapers abroad. Michigan, Gale Research Company, 1967. 243 p. $11.75.

This new directory is a guide to daily newspapers published in fifty-six countries where English is the minority language. The primary criteria used for selection are that each paper should appear at least five times a week and all or part of the editorial content should be in English. Much of the information appears to be based on a 1965 doctoral thesis.

Two hundred and two newspapers are listed by country of origin, under the town of publication. Unfortunately there is no straight alphabetical index to the titles. The information given includes the population and national languages of each country, circulation, publisher, date founded, editorial and advertising content, and a guide to the socio-economic class of readership of each newspaper. The appendices include a short bibliography, locations of microfilms of the newspapers in the United States, and the collected annotations for the whole volume.

A. F. Ridley

It is with much regret that we record the recent death of A. F. Ridley, Honorary Member of Aslib since 1951. Mr Ridley was a founder-member of the Association and organizer of its first conference in 1924. (See *Aslib Proceedings* vol. 19, no. 1, Jan. 1967, p. 20, 21; vol. 19, no. 2, Feb. 1967, p. 64–5; *Journal of Documentation* vol. 1, no. 1, p. 6–7).

CALCUTTA CENTRAL LIBRARY

THE TWO CULTURES IN INFORMATION WORK
THE SECOND ASLIB ANNUAL LECTURE

delivered by

SIR FRANK FRANCIS
Director and Principal Librarian, British Museum

Senate House, University of London, 23rd April 1968

'OH!' said Miss Dartle, 'Now I *am glad* to know that, I ask for *information* and I am glad to know it.' You will recall that when David Copperfield went to bed a little later on that night he was haunted by Rosa Dartle and her questions. He found a startling likeness of her, looking eagerly at him from the chimney-piece in his bedroom, and he wondered peevishly why they couldn't have put her anywhere else instead of quartering her on him. Though he undressed quickly, put out the light and got into bed, he couldn't forget that she was still there, looking. 'Is it really, though?' 'I want to *know*'—and when he awoke in the night he found he was uneasily asking all sorts of people in his dreams whether it really was or not, without knowing what he meant.

It is clear that David Copperfield would not have made a satisfactory information officer, if he let such questions keep him awake at night. I wonder what would have happened to him if he had had to put up with the years of acrimonious debate, discussion and study which we have had on this subject? I wonder, but I rather doubt, whether he would have chosen so obviously difficult a theme on which to address you. Whatever *his* feelings might have been, my own are of pride and gratification that you should have invited me to deliver the second Aslib Annual Lecture. It gives me the chance of acknowledging, on a very important occasion, before a very large audience, the debt I owe to my long association with Aslib. It is twenty-five years since I made my first bow to an Aslib audience under the auspices of Miss Ditmas, Mr Bobbie Carter and Mr Theodore Besterman, the officers of the Association at that time. I was at pains then to demonstrate that a great library, in particular the one I know best, the British Museum, was in fact a collection of important special libraries in both recognised and unrecognised areas of research, and that it was one of the responsibilities of such libraries to organize their services in such a way that individual richnesses, as well as the overlying unity of it all, could be deployed for the benefit of users at a variety of levels. I still believe this to be the case and I also believe that considerable advances towards the realization of this aim have been made. What I really set out to say at this point, however, is that the multifarious responsibilities of a great collection were most fruitfully brought home to me by familiarity with the work and objectives of the Association of

Special Libraries and Information Bureaux and I can assert with complete sincerity that my work as a librarian has been enormously enriched thereby. Aslib has impressively developed since that time, as is natural, but I still look back with pleasure and gratitude to those rather simpler, but at the same time very stimulating times.

It was about the time that I produced my paper, only twenty years ago, that S. C. Bradford produced his textbook[1], the earliest in this country, on the subject of documentation. He wrote in terms which seem, to our more sophisticated ears, rather simple and obvious and which make it difficult to realize that he was looked upon as a somewhat dangerously unorthodox pioneer and innovator:

'The art of documentation is the art of collecting, classifying and making readily accessible the records of all kinds of intellectual activity. It is the process by which the documentalist is enabled to put before the creative specialist the existing literature, bearing on the subject of his invesitgation, in order that he may be made fully aware of previous achievements in his subject, and thus be saved from the dissipation of his genius upon work already done. Documentation proceeds from the need to put in order the processes of acquiring, preserving, abstracting and supplying, as required, books, articles and reports, data and documents of all kinds. It is the result of the realization of the gap between the making of a record in any sphere of activity and the placing of that record in the hands of the individual who can use it as the basis of new achievement. The principal medium for recording progress is the periodical press, which speaks in so irregular and incoherent a manner, that it is impossible, without documentation, to obtain a clear and concise view of any particular branch of knowledge, large or small. This disorder reigns in the production of documents of all kinds. Documentation is the necessary remedy.'

What Bradford wrote in 1948 is still true and it lies at the root of our efforts to deal definitively with our information needs. We are still seeking the best way to ensure that the stores of potential answers which our institutions of information have already accumulated or are busily accumulating and our techniques for deploying them purposefully and fruitfully, match up with the needs of people of all kinds, who, like Miss Rosa Dartle, want or need to *know*.

Bradford was, if not in advance of, at any rate in the forefront of the campaigners for a very much more dynamic approach to this part of a librarian's duties. He was in fact in the direct line of the conscious creative thinkers on this subject from the first beginnings with Paul Otlet and Henri La Fontaine with their Brussels Institut International de Bibliographie, to what looks almost like its consummation in organizations like the great Russian Institute for Scientific and Technical Information, VINITI, whose tasks were enthusiastically described in the Report of the Joint DSIR-Aslib Delegation to Moscow and Leningrad in 1963[2]. This is what that delegation said about them:

'In the course of its first ten years of existence, VINITI has grown into the largest scientific information centre in the world with a permanent staff of 2,500, many of whom are highly-qualified scientists. Its work is helped by outside advisers from research institutes and industry, and by 22,000 specialists who are called upon for the preparation of abstracts.

The tasks which the organization sets before itself are set out as follows:

(*a*) the preparation of abstracts in the natural and applied sciences, excluding architecture, medicine and agriculture—over 700,000 abstracts are published each year in the *Referativnyi Zhurnal*;

(*b*) the organisation of instruction in scientific information in universities and institutes at undergraduate and postgraduate level; and

(*c*) the organization and co-ordination of research into the national organization of information activities, and the mechanical and automatic means of processing and retrieving scientific information.'

VINITI indeed represents a big-scale operation which indicates very clearly that the Russian Government has a deep conviction that the latest know-how in scientific and technological activities is worth what seems to us like unlimited effort and unlimited expenditure. A glance at recent OSTI *Newsletters* shows how extensively the scope and the work of organizations like VINITI are influencing our own information activities in this country. And I am sure that everyone will agree, wholeheartedly, that this is very satisfactory. Especially, perhaps, in the area of research, where so much has still to be learned on which to base our philosophy and our practice. One of the subjects on which much is still to be found out is how far the ideas which are being steadily developed in science and technology are applicable in other areas of study or indeed if they are as good as they should be in those for which they have been developed. Just as in the past our traditional approach to the work of a librarian failed to make us appreciate important new requirements in our work, so I think I detect a tendency at present to assume that a technique which has proved satisfactory in one area of our work, must *ipso facto* be equally good in all others. I am reminded of the young medical man who is alleged to have said, 'I diagnose typhus, because I am nuts on typhus'!

This preoccupation with science and technology, and the means of bringing the latest results of research to the notice of scientists is not at all surprising in view of the tremendous pressure of events, in an environment where the means for the marshalling and exploitation of scientific knowledge are evolving radically, and where experimentation with new forms is proceeding with unprecedented rapidity—and in a context where science and its products, in respect of industrial nations all over the world, have become major factors in national policies. In the broader context of the universities, Sir Eric Ashby has underlined this aspect of modern intellectual life: 'Formerly the universities were detached organisms assimilating and growing in accordance with their own internal laws. Now they have become absolutely essential to the economy and the very survival of nations. Under the patronage of princes or bishops they were cultivated as garden flowers of no more significance to the State's economy than the Court Musician. Under the patronage of modern governments they are cultivated as intensive crops, heavily manured and expected to give a high yield, essential for the nourishment of the state.'

No wonder that the essentials for scientific and technological advance need to be carefully fostered and developed. And yet, it must be insisted, science and technology on the one hand and the humanistic disciplines on the other are each, severally and together, the primary producers of excellence in Society.

To each is posed the challenge of how to serve Society in their special ways, without destroying or debilitating excellence in each other or in the Society of which they are the Servants.

I am indebted for the expression of these views to some striking remarks by the President in a recent Report of the Carnegie Institution of Washington[3] and I make no apology for quoting verbatim a further passage which seems to me to have an important bearing on what I have been saying.

'Throughout the history of science, as John Steinbeck has remarked, parts of the universe of experience have been rediscovered, redescribed, reclassified. Again and again an investigator of genius, gazing at the same world as his predecessor, has lifted a new corner of the veil of incomprehension and has glimpsed a new scene. In the excitement of the fresh vision there has typically been, at first, skepticism and controversy among those to whom the vision has not yet been granted. This, perhaps, is the most bracing and dynamic and stimulating period. Then, if acceptance follows, a band of believers slowly accumulates, extending the new ideas and confirming them in added ways. Gradually this group of disciples becomes more formalized, and the typical steps of post-discovery follow—evaluation, taxonomy, rearrangement in the new world of experience—until, a half generation or so later, a new structure has supplanted the old. Then it is that the ancient danger, against which the whole vista of organic evolution warns, becomes particularly acute. As Thomas Huxley emphasized many years ago, it is the common fate of knowledge to start as heresy and end as superstition. Characteristically it is the band of later believers—not the first discoverers—who, as the new system becomes codified and orthodox, forget the invariants in the evolution, the older common factors long proved viable that are as essential in the new structure as they were in the old, and that should provide a bond between the two. In their enthusiasm for the newly orthodox, they may press to discard all the features of the older frame, to start wholly afresh. Ultimately, as pattern-making proceeds in the new conceptual world, these older invariants, so lightly discarded in the period of change, typically emerge once more, to reoccupy in the new system the central position that they held within the old. But time and expensive effort will have been lost. How much more economical it might have been had their invariance been earlier recognized!'

It is in the light of these perceptive remarks that I approach the subject which I have chosen for this lecture. There can be no doubt in anyone's mind that it is most important that we should get our ideas straight on the subject of information. It would not be an exaggeration to say that, despite the optimistic note in the blurb for this talk, we are still some distance from full understanding of all that is involved and, while the overt antagonism which at times seemed to surround discussions on the differences between librarians and documentalists has largely disappeared, the relationship is still uneasy, there are still underlying suspicions about the intentions and the vested interests involved in the discussion and there is still a tendency to take up positions. It is vital for the well-being and the effectiveness of our library and information services that our doubts should be resolved. It is no comfort to us that the UK is not alone in this dilemma. Our country is small enough, goodness knows, for a useful dialogue, leading to deeper understanding between all those involved, to be easily arranged; the organization for a wide degree of co-ordination is potentially easy to bring about. Looking outside our narrow boundaries it might also be said that the achievement of a really effective national service could be an exemplar to many countries who are engaged in working out their own future information services.

There is certainly no place for the defeatist, near nihilistic, attitude towards some existing information institutions, which is not uncharacteristic of some recent pronouncements. Equally we can have little time for resentment on the part of such institutions if they are blamed for failure to understand and take regard for the changes in the demands made on a modern library service which have occurred in recent years. If there is need to re-think many traditional practices, there is also the necessity to understand the full range and depth of information requirements.

I propose to put the position as I see it before you, and if, in doing so, I have to say a good deal that is familiar, I hope you will excuse me. I begin by quoting at length a passage from an article by Dr Jesse Shera on the Library as an Agency of Social Communication[4], which seems to me to put the position of libraries in the community clearly and objectively:

'The act of communicating is, by definition, the transmission of a message from a communicator to a receptor. The message may be a simple signal or an extensive body of oral or recorded symbolic or pictorial representations. Communication can take place within an individual organism, between two individuals, or among the members of an aggregate, but always there is a mutually intelligible "language" as well as a carrier or medium; and while there may be multiple receptors, in any given instance there can be only one transmitter. Just as in the biological organism there is a neural communication system, so in organized societies there is a social communication network. While the agencies which are a part of this network are easily recognized and their functions easily identified, the fundamental nature of the communication process within society is only imperfectly understood. Students of society know lamentably little about the ways in which knowledge and information are communicated within a culture, even a primitive culture. For that matter, psychologists and specialists in the operation of the human nervous system know precious little about the communication of information within the individual. Analogies have been drawn with the electronic circuitry of the computer just as the communication of information within a society has been likened to the spread of epidemics in a population.

'Graphic records are both an extension of and a check upon the accuracy of the human mind. They are, in the terminology of the semanticist, "time binders" which span the temporal and spacial distances of our three-dimensional world. The document is an extension of the human powers of communication, and the library is a means for extending the life-span of the document. Like all other social agencies, it has arisen from, and is shaped and reshaped according to, social necessity. Thus, as graphic records came into being in response to the need of society for a medium that would communicate messages essential to the operation of the social structure, to religious doctrine or ritual, or to any other activity in which the members of the society might engage, so there arose the demand for an agency to control such of those records as needed, for any reason whatever, to be preserved. From the very beginning, libraries have always been an integral part of the "business" of operating a society, hence a legitimate collective concern. As the culture matured and became more sophisticated, its dependence upon graphic records increased, and changes in the culture were reflected in the librarian's responsibilities.

'The librarians of the great collection at Alexandria were much more than mere keepers of the papyrus rolls. They were scholars who studied the texts in their care, participated in the educational and religious activities of their society, and in a variety of ways were an influential force in the total communication system. The medieval libraries and the libraries of the Renaissance did not basically alter these original functions, they only directed them into different channels, again according to their respective social milieus. The invention of printing and the rise of scientific inquiry broadened and increased the importance of the librarian's role. Not only did books become more plentiful than they had been during the centuries before Gutenberg, but also the libraries in which they were housed were in a very real sense the laboratories of the scientists. From the seventeenth century to the beginning of modern times, the scientist had only the most meagre of apparatus with which to conduct his investigations. He found it necessary, therefore, to turn to the writings of his predecessors as the most important single source of the knowledge that he needed.

'The invention of printing released the bonds that had so firmly restricted knowledge to the privileged few, and made possible, during the nineteenth century, the realization of the American dream of universal education...

'The complex communication system that operates today in the Western World depends upon many instrumentalities, of which the library is but one. One need not dwell upon the impact that the telegraph, the telephone, the radio and television, not to mention the newspaper and the periodical, have made upon the communication patterns of our society. Each of these has had its effect upon the rôle of the library. With them has come a new urge on the part of the librarian to assume a vigorously active rôle in communication. Librarians no longer are content to accumulate materials in anticipation of use, but seek to engage actively in bringing their resources to the attention of those who need them. The growing importance of all types of graphic records to the successful operation of contemporary society, conditioned as it is by and to science and technology, has forced the librarian to search for and adopt new methods and techniques for making recorded information available not only to scholars but also to business, industry, and government.'

I should like to emphasize these last two sentences, for I sincerely believe they do represent the views of the thoughtful librarian. As Bradford[5] says:

'No efficient information service can exist, without an extensive library. Access to the literature is essential at every stage in the process of making information readily accessible.

'It is abundantly clear that the establishment in each country of such a central library of science and technology would alleviate the disabilities under which scientific and technical work is carried out at present, while the additional cost of such a library would be small compared with the advantages gained.

'Specialist libraries large and small would remain the primary sources of supply for information on subjects within their proper fields. When the search needed to be extended into the mass of literature on cognate subjects, the inquiry would be transferred to the central library.

'The function of the central library would be to maintain a complete—as distinct from a partial—collection of literature, which could either be consulted by the specialist in his more exhaustive researches, or by the central library's own staff for the provision of bibliographical lists. It would not be the province of the staff of the central library, except insofar as they were particularly expert in certain fields, to extract from the references listed the precise significance of the information in respect to the special inquiry. That function would remain for the specialist and to some extent for the special librarian or the staff of experts available for his consultation.'

The thoughtful librarian, however convinced he may be, and however determined to interpret his job in a creative fashion, has been impeded in carrying out his intentions by a number of factors which create great problems for him, some of them perhaps brought on him by himself, some over which he has no control. The chief of these is the great growth in the output of significant publications from the printing presses of the world and this not only in the countries which have been traditionally regarded as the main sources of accessions to our research libraries, but from many other countries where developments of great potential significance are taking place. Space to house increasingly large accessions is a continuing need, but as I have said again and again, space for this purpose need create no great problem; the real trouble in our great libraries is lack of space and of means to deal adequately in the first place with the necessarily increased routine procedures arising both from the greatly increased number of accessions and from the ancillary requirements of improved bibliographical control, and in the second place to provide means for the full and fruitful use of the increasing collections. This is not a moan. It is plain common sense that increasingly valuable tools and equipment should be provided with the necessary space and conditions for their deployment. I might mention in this connexion that, as you know, a very considerable enlargement of the Library of Congress has been agreed, which will give that library double its present space, and that other great libraries, e.g. the Lenin Library in Moscow, the Bibliothèque Nationale, the Swedish, the Belgian, the Japanese national libraries, have extended or are all greatly extending their space. The second factor which has had an inhibiting effect on the work of our research libraries is the difficulty they have had in increasing their staff establishment to deal with the increase in the size of the collections and with the greatly enlarged demands for information and bibliographical help which the increased complexity of the collections make upon them. This is particularly galling when librarians are evincing as never before the desire and determination to respond to the needs of their users. There is also another side to this: the professional and academic competencies of library staffs are being wasted because they are having to be used for routine tasks well below their qualifications. Academically qualified staff who are thus unable to play the part they should be playing in providing direct help to users and in doing creative bibliographical work become depressed and discouraged and their imagination and their enterprise dulled. How much anxiety this situation causes and how widespread it is can be studied in a long article contributed to *Libri* in 1960 by Dr Joachim Wieder, at that time Bibliotheksrat in the Bayerische Staatsbibliothek in Munich and Secretary of the International Federation of Library Associations. His paper, entitled 'Berufssorgen des wissenschaftlichen Bibliothekars', deals at length with the matters I have mentioned and was supported later by contributions from Dr Leendert Brummell, then Royal Librarian in The Hague, and M Jacques Lethève, at that time Conservateur in the Bibliothèque Nationale in Paris and Secretary of the Association des Bibliothécaires Français.

It is indeed true that libraries—the research libraries in particular—need more space, more staff and greater funds to carry out adequately the full range of duties which they look upon as proper to their job. But this is nothing new: pressures due to growth have long been familiar to libraries. There is unfortunately a peculiar, and perhaps infectious, belief in many quarters that a library becomes a liability rather than an asset because of its growth. This question of growth recalls the elderly gentleman who was asked if it were not awful to be growing older and older, 'No', he replied, 'it ain't awful. If I weren't getting older I'd be dead!' Libraries, too, when they stop growing will be dead. The situation has become critical largely as a result of greater insistence on the part of some users of libraries for a special kind of service, which libraries have for the most part been ill-designed to meet and which they have also in many cases, been regrettably slow to anticipate. A temporary embarrassment in meeting a new situation, however, is a small reason for the doctrine, put forward by certain documentalists or information exponents or even librarians, carried away by the over-simplifications of specialization, that large libraries are the dinosaurs of the present age, doomed to disappear because of their inability to adapt themselves to the conditions of modern life or to provide for the future.

A librarian does not need to be a Zadig, who you remember was what Huxley called a retrospective prophet, to read the signs which tell him of the new circumstances with which he has to cope, nor does he need to be an Admirable Crichton to find the means of doing so. His requirements can be neatly expressed by a few famous words which will be not unfamiliar to you: 'Give us the tools and we will finish the job'.

Not of course that this is a job which has any other finite end than that of satisfying the diversity of users now and at all times. I have up to now been stressing the *problems* facing the big libraries. It is time that I reminded you of their positive achievements and the advantages they can confer. In the first place, they have nothing to do with the separation of the cultures, be the separation between Lord Snow's over-simplified two, or Michael Yudkin's dozens. They provide the meeting place for all cultures, areas under active cultivation as well as those lying fallow; they amass material essential for interdisciplinary studies as well as for those studies connected with particular disciplines; they have a responsibility to conserve their stocks and make them permanently available; they purchase widely in all the languages of the world; they provide informative catalogues; they have staff, skilled in academic subjects and in most languages, available to give help and advice at all times; and they maintain reference rooms open to the public for the study of their collections. None of these services can be provided by any other library or combination of libraries without inordinate waste of resources and a grievous loss of efficiency.

The worth and importance of the world's great research libraries may thus be taken as virtually self-evident. We are not here concerned, however, with the worth and the importance of these libraries, but with the adequacy of their performance or potential performance in the face of rising demands for special types of services.

It is not, unfortunately, easy to find *explicit* indications what these special types of service which are required are. Opinion has still to some extent to be deduced from hearsay evidence. My own deductions were expressed at the Unesco Symposium on National Libraries in Europe[6] in 1958, in the following terms:

'The problem of providing information through libraries and similar institutions has not changed in principle throughout the ages. Changes, however, have taken place in the type of service demanded. These affect the large comprehensive libraries in two special ways: first in the matter of the speed with which information is required, and second the range of publications called for. Whereas up to a few years ago a library was looked upon as the natural resort of scholars for the study of books, monographs and periodicals (usually in that order of importance), nowadays, for a variety of reasons, study of the old-fashioned kind appears to be rarer, and a considerable proportion of the demands made upon libraries is for quick reference to specific information, largely in periodicals and in what is now called report-literature. There is a perfectly understandable insistence on speed and immediacy which puts out of question the leisurely browsing among catalogues and bibliographies which is typical of many of the older libraries, and which makes it essential in the case of reference, i.e., non-lending, libraries to provide the closest possible approximation to an over-the-counter service if they are to satisfy the research worker and the scholar in the exact sciences and in technology and industry. The special libraries which have sprung up in the last few years endeavour to supply such a service and their success has underlined the need for library service of this kind. The large comprehensive library cannot, even if it wishes, avoid responsibility here, because it often has material which is not available in the special libraries. In any case the popularity of the special libraries has shown that speedy service is highly appreciated by library users, and the big libraries should surely rejoice in the challenge represented by this new requirement.'

It is essential for the full use of printed information that the special libraries should continue to exist. They have undoubtedly a most important part to play in technological, industrial and commercial development. The services which these libraries can perform, however, are limited: special libraries connected with societies, commercial firms, research associations and professional bodies have their own local problems to meet, and despite the useful and at times very impressive system of mutual aid they have built up, they are limited in the range of their operation—one has only to think of the information already coming or likely to come from far-distant countries using unfamiliar languages, of the cost of purchasing such material and of storing it, to realize that the large comprehensive library cannot avoid responsibility in these areas of study.

These views are supported in some degree by papers delivered at the Monticello Conference[7] on 'Problems and Prospects of the Research Library', in 1955. Professor Morse, a physicist at MIT, spoke as follows: 'The dynamic use factor—actual use now—is the controlling factor from the standpoint of the research physicist. In the humanities, on the other hand, the *potential* use factor may be almost as significant, a book may be very important later though it is not used at all for five or ten years. For the research physicist, however, this potential use factor can be ruled out almost completely. Things that were written twenty-five years ago are worse than out of date, they are erroneous ... The research physicists' library is a much better library if it does not contain books that are very rarely used. Our figures indicate ... that a good working collection of from three to eight thousand volumes can contain all the books that are used once a year or more ... Promptness in acquiring material and making it available is probably more important than in other fields ... I can only emphasize the fact that the physicist does not want (outmoded books) on the shelves holding the books he is using daily, that he does want to get the new material there as quickly as possible and that he wants to be able to find it without searching catalogues and classification systems.'

'An historian', maintained Professor W. B. Hamilton[7], 'is the most arrogantly catholic consumer ... He takes all knowledge, including fields Bacon never ever dreamed of, as his province. A single lecture ... to say nothing of a research problem, is likely to take him over a wide range of subjects and areas. As soon as the researcher in English and American literature departs from analysis of a text itself, he is in the same predicament. The political scientist or the economist, who is not a very narrow specialist indeed lives on a very varied diet. And as for the sociologist, with the vague boundaries of his subject added on to its terminological vagaries, I know not how he finds his material. The tremendous range of the social scientist and the humanist is alone sufficient justification for my conviction that we need plenty of subject cards in the catalogue.' Professor Hamilton goes on to draw an analogy with a stone thrown into a pond ... 'The circles of disturbance from the stone ripple away in ever widening enquiry, one thing leading to another; there is a great deal of orderly search through indexes of periodicals and series; a painful winnowing of newspaper chaff; the exciting reading of pertinent manuscript collections ... the haphazard leafing of dirty pamphlets whose titles are meaningless. Some of the finds are even pure accident, the product of a passage by a bookshelf on a dull day. Frequently the researcher has no idea, when he plunges in, what topics are going to confront him around the next corner.'

Unfortunately, Professor B. H. Flowers's *Survey of information needs of physicists and chemists*[8], prepared for the Advisory Council on Scientific Policy in 1963/64, is not very helpful in the particular question I am dealing with at the moment, largely because the questionnaires used did not pose any questions regarding the use of the national libraries. His findings, however, include the following statements: 'Earlier surveys, restricted to industrial scientists and technologists, showed an overwhelming preference for personal contacts, little interest in the literature and a general satisfaction with the methods used for getting information. In the present survey, there is no such general satisfaction with presently available methods for getting information, and this leads to the conclusion that pure scientists are more dependent on the literature than industrial scientists and technologists.' 'Experience at the National Lending Library suggests that scientists in general do not know how to make the best use of existing services, and the task of providing them with more effective training (at the beginning of their careers) must be pursued, along with the improvement of existing retrieval services.'

The large number of special libraries in the fields of science and technology—there are likely to be as many as 1500 in this country—is an indication that where specialized, *ad hoc* services can be provided their value is unquestioned. Special libraries tend to be small—they may be only one-man or two-man units—though they may be large enough, and their services comprehensive enough, to employ as many as 50 persons; they tend to acquire and keep only such documents, journals, reports, monographs, patents, for which there is likely to be a regular demand. They thus need to be supported at a centre able to supply speedy information or equally speedily to provide access to material not in the special library, especially where specific references are not available.

The idea, however, which is held in some quarters that a network of special libraries can in some degree replace a central, comprehensive collection is really quite untenable. The reasons why this is so are not difficult to summarise: such libraries are created for the needs of particular groups or for particular purposes; no-one takes responsibility for the subjects which do not happen to fall within the sphere of interest of any of the groups; fringe material tends to be neglected or duplicated; valuable skills in languages for example are either not available or again are wastefully duplicated; popular, non-academic literature which may be important for sociologists, psychologists, historians, philologists is not taken; the dividing line between subjects is difficult if not impossible to draw; no responsibility will be taken for preservation on a permanent basis; central control would be necessary to weld the services of a multitude of libraries together and this would have all the responsibilities of a library but would have no books on which to draw for its expertise. In fact, as S. C. Bradford pointed out at the 1935 Conference of the International Institute of Documentation[1], speaking on a library service for science and technology, in which he envisaged a general library of science and technology where all existing literature on a particular subject can be consulted in one place, 'The conclusion is inescapable that true economy and efficiency tend in the direction of developing the existing facilities of an existing general science library as a central library for science.'

The passages I have quoted and the considerations I have put forward seem to me to point inevitably to the conclusion that the demands for information are unpredictably heterogeneous and that it is only in the most comprehensive and the most responsively and flexibly organized library that they can be adequately met.

The idea sometimes propounded that the needs we have been considering can somehow be met by a by-return *lending* library and by a number of small, specialized libraries is dangerous in its over-simplification of the problem. It is easy to assemble a great body of homogeneous material and to provide a lending service, given the means to purchase widely; but its use is for those only who can identify and specify their detailed needs. In so far as the research worker or the student cannot do this, we are running into the danger—always to be feared and guarded against—that available collections are only fractionally used, and that users are satisfied with what someone happens to put before them.

We must certainly have a lending service—and here let me pay a tribute to the success that has attended the imaginative efforts of the National Lending Library at Boston Spa—and we must also depend very heavily on the services which are provided by special libraries and local information services. But for a full information service in depth we must have comprehensive collections, serviced and documented by specialists with whom either directly in person or by telephone or correspondence informed discussion both as to requirements and the means of satisfying them can take place. It is important that *quality* in information exchanges should be inculcated and developed. Over-simplification and superficiality are only too insidious dangers.

In any case, there are many areas of study, as has been shown, where requirements cannot be specified in advance. The information-stimulus may consist in the fertilization of a mind by discursive reading and the experience of the work of other students. These characteristics may be typical of the humanist and also of the student in social studies. But if there is one lesson which seems to stick out a mile it is that various disciplines or units of learning simply will not arrange themselves into permanently valid divisions.

Whatever *ad hoc* arrangements we make for the provision of information, and this is something we are always having to do, it seems clear to me that we cannot follow Lord Snow into the realms of a two-culture or any multi-culture division of learning. I am reminded of a passage in a speech by Dixon Wecter, formerly a professor of history at Berkeley; speaking of the dangers inherent in over-specialization he said, 'To learn how natural sciences are actively re-making the world is no less necessary for the humanist, than, for the *scientist*, the instruction of humanism about man's place in that world. The great research library is the custodian of the world's actual knowledge and the reservoir of its potential knowledge.'

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MAYERHOFER, JOSEF
Betrieb wissenschaftliche Untersuchungen in österreichischen Bibliotheken; aus der Tätigkeit des Osterreichischen Instituts für Bibliotheksforschung, Wien. [Scientific investigations in Austrian libraries; Work done by the Austrian Institute for Library Research, Vienna.] *Zentralblatt für Bibliothekswesen*, vol.82, no.3, March 1968, p.129–40.

MELCHER, DANIEL
Automation: rosy prospects and cold facts. *Library Journal*, vol.93, no.6, March 1968, p.1105–9. Describes a publisher's experiences with computerization.

MILLS, ELIZABETH
The separate undergraduate library. *College and Research Libraries*, vol.29, no.2, March 1968, p.144–56. Discusses some of the thinking that preceded the development of separate undergraduate libraries. It analyses three of them—Lamont, Michigan, and UCLA in some detail and speculates as to their future.

MITTAL, R. L.
Teaching of library science in India. *Libri*, vol.17, no.4, 1967, p.252–69.

MONTAGUE, BARBARA A., *and* SCHIRMER, ROBERT F.
Du Pont central report index; system design, operation, and performance. *Journal of Chemical Documentation*, vol.8, no.1, February 1968, p.33–41.

MUMFORD, L. QUINCY
Bibliographic developments at the Library of Congress. *Libri*, vol.17, no.4, 1967, p.294–300. A paper presented at the 33rd session of the IFLA General Council, Toronto, Canada, August 1967.

NEELAMEGAN, A.
Research in library science; the why and the how. *Herald of Library Science*, vol.6, no.2/3, April/July 1967, p.113–20. The factors to be taken into consideration in the organization of and in assigning priority to different kinds of research in library science in India are briefly outlined.

NISTOR-DOMONKOS, E., *and* ROMAN, ELIZA
Despre programarea la maşina electronică de calcul a lucrărilor de bibliotecă. [Programming librarianship on computers.] *Studii si cercetari de documentare si bibliologie*, vol.9, no.4, December 1967, p.445–52. Deals with various aspects of the use of computers in librarianship. An analysis is made of the automated charging and cataloguing of books.

NOLAN, K. P., *and others*
Mechanized circulation controls by K.P. Nolan, F.S. Cardinetti and W.A. Kozumplik. *Special Libraries*, vol.59, no.1, January 1968, p.47–50. The use of mechanical equipment in controlling circulation of books and reports in a large aerospace library is described.

MULLER, HERBERT E.
Bericht über den Stand der Mikrofilmnormung. Neue AWV—Richtlinien für Zeichnungsverfilmung. [The current state of microfilm standardization. AWV recommendations for filming of drawings.] *Reprographie*, no.3, March 1968, p.59–60. Co-operation of different organizations Formation of the Committee 'Technique of microfilm and copying'. Standard draft DIN 19052.

OPTISCHES Kopiergerät als Hilfsmittel beim Mikrofilm für Zeichnungen. [An optical copying apparatus as an aid in using drawings on microfilm.] *Reprographie*, vol. 8, no.4, April 1968, p.96.

PELTZ, MARGARETA, *and* STEFANESCU, MARINA
Aspecte ale documentării mecanizate în ştinţele geologice şi conexe. [Some aspects of mechanized documentation in geology and related sciences.] *Studii si cercetari de documentare si bibliologie*, vol.9, no.4, December 1967, p.421–7. For the first time, in Roumania, attempts have been made to put into practice a system of mechanized information, actually in the field of natural sciences. The results obtained are discussed.

PERSCHKE, SERGEI
Machine translation—the second phase of development. *Endeavour*, vol.27, no.101, May 1968, p.97–100. Reviews historical development of machine translation against the background of work carried out by Euratom at Ispra in Italy.

PLUMBE, WILFRED J.
Another appraisal of the Stripdex catalogue. *Library Review*, vol.21, no.5, Spring 1968, p.234–6. Comments on an earlier article on the Stripdex catalogue.

POLZOVICS, IVAN
Doisprezece ani de experienţă în informarea selectivă la nivel naţional şi internaţional. [Twelve years experience in selective dissemination according to national and international requirements.] *Studii si cercetari de documentare si bibliologie*, vol.9, no.4, December 1967, p.429–35.

PRESCHEL, BARBARA M.
The information center on crime and delinquency. *Special Libraries*, vol.59, no.1, January 1968, p.40–6. The center is attempting to provide bibliographic control of the publications in its field and related fields, and a list of summaries of pertinent, current, action, demonstration and research project. It is also attempting to serve as an information source on specific problems.

PRODAN, T., *and* PELTZ, M.
Din experienţa aplicării indexării coordonate pentru utilizarea informatiilor din publicaţiile periodice. [Practical results of the application of co-ordinate indexing in the utilization of information from periodical publications.] *Probleme de documentare şi informare*, vol.2, no.2, February 1968, p.91–110.

REIMERS, PAUL R.
The effective use of bibliographic information and the role of automation in this process. *Libri*, vol.17, no.4, 1967, p.305–13. A paper presented at the 33rd Session of the IFLA General Council, Toronto, Canada, August 1967.

RESEARCH in librarianship and professional training. *Unesco Bulletin for Libraries*, vol.22, no.1, January–February 1968, p.29–32. Information on three new Unesco-assisted projects designed to promote research in librarianship and to improve the existing situation with regard to the professional training of librarians.

ROBERTS, NORMAN
Public libraries in Poland; personal impressions. *Library World*, vol.69, no.814, April 1968. Impressions of a visit to Poland in 1967 to see information centres, public, academic and special libraries and library schools.

ROSENBLUM, MARCUS
The publication process seen as a biological phenomenon. Extracted from *AIBS Bulletin*, vol.12, no.6, 1962, p.21–3.

SAXENA, K. K.
Preservation of manuscripts and documents. *Indian Librarian*, vol.22, no.3, December 1967, p.153–6.

SHERA, JESSE H.
Of librarianship, documentation and information science. *Unesco Bulletin for Libraries*, vol.22, no.2, March/April 1968, p.58–65. Discusses content and definitions of the three terms.

SIMMONS, JOSEPH M.
Business records in the company archives. *Special Libraries*, vol.59, no.1, January 1968, p.20–3. Recommends the setting up of a formal archival programme to preserve legal documents, contracts, financial records, correspondence, as well as house publications, etc.

SKIPPER, JAMES E.
International implications of the shared cataloguing program: introductory statement. *Libri*, vol.17, no.4, 1967, p.270–5. A paper presented at the 33rd Session of the IFLA General Council, Toronto, Canada, August 1967.

SKOLNIK, HERMAN, *and* CURTISS, RUTH E.
A mechanized information system for many outputs from one input. *Journal of Chemical Documentation*, vol.8, no.1, February 1968, p.41–5.

SMIRNOVA, S.
Patentnaya literatura v universal'nykh bibliotekakh. [Patent literature in general libraries.] *Bibliotekar'*, no.4, 1968, p.36–40.

SRIVASTAVA, S. N.
Library legislation in India. *Indian Librarian*, vol.22, no.3, December 1967, p.148–52.

STEER, VINCENT
Typographical potpourri. *Small Offset User*, vol.17, no.197, March 1968, p.198–203.

TĂRĂBOI, V.
Problemele actuale ale documentării şi informării şi possibilităţi de rezolvare a lor în cadrul unui sistem naţional. [Actual problems of documentation and information and the possibilities to resolve them within a national system.] *Probleme de documentare şi informare*, vol.2, no.1, January 1968, p.3–8.

THIBAULT, M. R.
Technical information for foundry management. Copied from *British Foundryman*, vol.61, no.3, March 1968, p.85–9. The main sources of foundry technical information-periodicals, abstracts bulletins, lecture courses and enquiry services are set out and a brief description of the way in which an information service is built up.

THOMPSON, G. K.
Computerization of information retrieval and index production in the field of economic and social development. *Unesco Bulletin for Libraries*, vol.22, no.2, March/April 1968, p.66–72. I.L.O. 'codeless scanning' technique with a Flexowriter and IBM 360/30 computer.

TORRANCE, DON
Microtechnology; a problem in dissemination. *Sci-Tech News*, vol.22, no.1, Spring 1968, p.7–8. In recent years, NASA contractors have been taking part in a programme of information dissemination through automatic mailing of microfiche documents. This programme has many aspects reflecting on the librarian's professional functions.

VALLEE, JACQUES F., *and others*
Retrieval formulae for inquiry systems by Jacques F. Vallee, Gilbert K. Krulee and Albert A. Grau. *Information Storage and Retrieval*, vol.4, no.1, March 1968, p.13–26. Discusses the design of automated information-retrieval systems which accept questions in ordinary English and yield as output a numerical answer.

VARGA, D.
The machine translation strategy [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya. Seriya* 2, no.2, 1968, p.32–6.

VOSPER, RICHARD
International implications of the shared cataloging program: planning for resource development. *Libri*, vol.17, no.4, 1967, p.285–93. A paper presented at the 33rd session of the IFLA General Council, Toronto, Canada, August 1967.

WEISS, CH.
The library of the forestry division of the Volcani institute of agricultural research in Ilanot. *ISLIC bulletin*, vol.1, no.4, March 1968, p.11. A summary in English giving details of size, stock and services of the Institute's library.

WERNER, PRASSE
Medizinische Bibliotheken, Information und Leihverkehr. [Medical libraries, information and lending.] *Zeitschrift für Bibliothekswesen*, vol.82, no.3, March 1968, p.147–53.

MEMBERS' ADVERTISEMENTS

Acceptance of advertisements for publication in Proceedings *does not imply Aslib support for or endorsement of the goods or services advertised.*

The charge for advertisements in these columns is 4*d* per word, minimum 5*s*. An additional charge of 6*d* is made for the use of a box number.

AUTHORITATIVE TECHNICAL TRANSLATIONS from French, German, and Dutch into English and from English, French and German into Dutch, specialities electronics, optics, instruments, photography, API Ltd, director K. S. Ankersmit, FIL (French, German, English), 19 Godstone Road, Purley, Surrey. BYWood 3781.

TECHNICAL SWEDISH, DANISH, NORWEGIAN translated by J.T. Craddock, B COM, FIL, Ekard, Ray Park Avenue, Maidenhead, Berks. Maidenhead 24931.

WILFRED E. GOODAY, ARSM, DIC, MIMM, FIL. Member of Translators' Guild, Romanian and French. 161 Rivermead Court, London SW6. RENown 1912.

MEDICAL, PHARMACEUTICAL, BIOLOGICAL translations from French, Rumanian and Portuguese into English and from English into French and Rumanian. Dr J. Jacobson, 94 Temple Fortune Lane, NW11. 01-455 1010.

FROM ARABIC TO ZULU translated into and from English with almost as wide selection of subjects. For prompt and personal service apply to M. Januszewicz, Grde.Sc.Agr., 12 Roland Street, St Albans, Herts.

TECHNICAL TRANSLATIONS from Russian, German and Polish into English. B. Klipstein, B SC(HONS). 1 Glenview Grove, Shipley, Yorkshire. Tel. Shipley 58215.

TECHNICAL AND COMMERCIAL translations from English into Russian. Mrs O. Linsley, 31 Parke Road, Barnes, London SW13. Tel. 01-748 8822.

TRANSLATIONS FROM TURKISH. All subjects. F. P. Scott, 4 Uphill Grove, Mill Hill, London NW7.

ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 July 1968 Number 7

ASLIB CALENDAR 1968

September

TUE.17 – FRI.20.	Course on work in hospital medical libraries.
SUN.22 – WED.25.	42nd Aslib Annual Conference at Canterbury.

October

WED.9.	Chemical Group: symposium on toxicity.
THU.10.	One-day conference: Engineering Information Services.

November

TUE.12.	Chemical Group Conference.
THU.14.	Economics Group visit to *Financial Times.*

1969

April

TUE.15 – THU.17.	Chemical Group Conference.

Aslib and the Library Association

In July 1967, the Library Association suggested that representatives of the Association should meet representatives of Aslib for informal discussions, without commitment on either side, on the possibility of a closer association between the two organizations. The Honorary Officers and Director of Aslib agreed, and the first meeting was held in October.

It rapidly became apparent to both parties that any advantages in an outright amalgamation of the two Associations would be heavily outweighed by the disadvantages and that such an amalgamation was not, in fact, practical. It was then agreed to consider a division of functions based broadly on the kind of division common in the scientific world, i.e. two organizations working in parallel, one (the LA) drawing support from individuals and looking after their interests as individual members of a professional body, and the other (Aslib) drawing support from organizations and oriented towards the development of library and information services by means of research and other activities.

The Secretary of the LA and the Director of Aslib undertook to draw up a statement showing a possible redistribution of activities on these lines, but this arrangement also produced difficulties for the LA which concluded that no further progress could be made. It remains the hope and intention of both organizations to continue to collaborate wherever possible. In fact, the examination of their respective activities with a view to their re-distribution showed that the degree of overlap is extremely small, and both associations are agreed on the importance of ensuring that it does not increase.

LA President

Mr Wilfred Ashworth, Librarian and Information Officer of ICI Fibres Ltd., at Pontypool, has been nominated President of the Library Association for 1969. He will be the first President of that Association to come from the field of industrial and special librarianship.

Mr Ashworth has long been an active member of the Councils of the Library Association and of Aslib (Chairman 1961–2) and has served on Aslib committees and lectured at meetings. He is known to an even wider audience as the editor of the *Aslib Handbook of special librarianship and information work.*

Indexing systems

The Aslib Cranfield Research Projects into the efficiency of indexing systems have shown that some widely held ideas about systems of information retrieval can be called in question. Many problems remain to be solved before information systems can be designed with the confidence that the results will fit the requirements. As part of the research effort in this country, the College of Librarianship, Wales, has begun a two-year investigation into indexing systems, supported by a grant of £6,881 from the Office for Scientific and Technical Information (OSTI). Four types of indexing system will be compared: a post-coordinate keyword system; a faceted classification scheme; relational indexing; and the SMART computer system using document abstracts.

Using a collection of items in the field of Library Science and Documentation, indexes for the systems will be constructed. Sets of search requests will be obtained and the relevance of each item in the collection to each request will be established by subject experts. The searches will then be performed using the indexes, and the results in each case compared with the established decisions. The systems will be compared with each other both from the point of view of retrieval effectiveness and from that of the amount of effort required to operate them. A further part of the investigation will be concerned with methods for making comparisons of this kind, since experimental techniques for testing indexing systems still require further development.

Results using the SMART computer system will be made available by Professor Gerard Salton, of Cornell University, USA.

The Project is under the direction of Mr A. C. Foskett of the Department of Information Retrieval Studies. The Senior Researcher is Mr E. Michael Keen, who has recently joined that staff of the College after working on the SMART Project for one year, having previously been with the second Cranfield Project for over three years.

Further information may be obtained from Mr E. M. Keen at the College of Librarianship, Llanbadarn Fawr, Aberystwyth, Cardiganshire. Telephone No. Aberystwyth 3842.

Computer-based Current-awareness Services in Chemistry

Since January 1967, The Chemical Society Research Unit in Information Dissemination and Retrieval has operated a computer-based current-awareness service for a selected population of about 250 United Kingdom chemists and users of chemical information. 'Profiles' derived from the user's statement of research interest are matched each fortnight against magnetic-tape versions of the Chemical Abstracts Service publications, *Chemical Titles* (*CT*) and *Chemical-Biological Activities* (*CBAC*). Descriptions of the work being done by the Unit can be found in *Chemistry in Britain,* 1967, 3, 19 and 509; 1968, 4, 71 and in *Svensk kemisk Tidskrift,* 1968, 80, 39. A more general description of computer-based chemical information services can be found in *Chemistry in Britain,* 1966, 2, 441 and numerous US publications. This experiment comes to an end in June 1967.

An opportunity now arises for a much wider and larger chemical audience to use these services and assess the techniques for themselves. The Chemical Society will provide, through its Research Unit in Information Dissemination and Retrieval at Nottingham University, and with support from the Office for Scientific and Technical Information (OSTI), a *CT* and *CBAC* service available to all for a year beginning 1st July 1968. Although these services remain experimental and are still developing, it is not possible to continue these services free-of-charge; they will be made available on a cost-recovery basis.

Further information, a detailed specification of the service, and of the charges, can be obtained from: The Editor, The Chemical Society, Burlington House, Piccadilly, W1, *or* The Director, The Chemical Society Research Unit in Information Dissemination and Retrieval, The University, Nottingham, NG7 2RD.

Social Science Newsletter

The main section of the current edition of the Social Science Research Council's *SSRC Newsletter* is devoted to the information problems of social scientists. Maurice Line, Librarian at Bath University, outlines the problems and the research at present aimed at solving them, concluding that most of it is of little use, and calls for research specifically directed at researchers' *needs*: 'we cannot design a system to meet needs which have never been analysed or specified'.

Another article describes the dozen or so research projects on social science information supported by the Office for Scientific and Technical Information (OSTI), and there are notes on the SSRC's Data Bank and its catalogue, on the Central Statistical Office's new quarterly, on an SSRC survey on data collected by the Government, and on the School of Oriental and African Studies' Asian and African indexes.

This is the third edition of the *SSRC Newsletter* (it is issued three times a year). Previous editions have contained a proposal by Professor W. J. M. Mackenzie to set up a National Social Sciences Library and a strong plea for more space at the Public Records Office.

The *SSRC Newsletter* is available free on request from the Social Science Research Council, State House, High Holborn, London WC1; tel 01-405 6491.

Information Scientists' 1966 Conference Proceedings

The recent publication of the OECD's General Report *Scientific and technical information systems and policies* lends welcome support to one of the themes of the 1966 Conference of the Institute of Information Scientists now published. One of the outstanding papers of the conference was Mr Peter Judge's on 'Governments, Policy and Information', in which he examined the ways in which governments see the problems of scientific and technical communication and gave examples of the kind of action that European governments have taken to bring their attention to bear more closely on these problems. He also looked at the national and international implications of governments involved. Mr Judge is head of the Section for Scientific and Technical Information of OECD and has been very much involved in the work of OECD Information Policy Group. Also highly relevant to the OECD report are the two papers which describe information science and services in Holland and Federal Germany, and the paper by Kjeld Klintøe on the Danish Technical Information Service. Amongst the other topics discussed at the conference were computers in information work, the costing and organization of the systematic dissemination of information, and methods of keeping in touch with the needs of information users. Copies of the Proceedings, which were published at the beginning of this year, are available from S. R. Loynes, Wiggins Teape Research & Development, Butlers Court, Oxford Road, Beaconsfield. The price is 30*s*, post paid.

Technical Journals for Industry

Two more national lists in this series have been published as part of the FID 415 project. These are for Denmark and Italy, and are obtainable from the issuing organizations: Dansk Teknisk Oplysningstjeneste, Copenhagen, and Consiglio Nazionale delle Richerche-Sezione Rilevazioni del Servizio Studi e Rilevazaione, Rome.

REVIEWS

PENDLETON, O. W. How to find out about insurance. Oxford, Pergamon P., 1967. x, 196p.

This book provides a valuable and comprehensive guide, the first of its kind in this country, to sources of information and literature on insurance. Intended primarily as a tool for librarians and insurance students, the general reader will also find it admirably organized and lucidly written. In comparatively few pages, it manages to cover basic sources of insurance literature, including foreign language sources, insurance education, professional organizations, the history of insurance, and a basic bibliography of modern insurance. Altogether, a recommended addition for reference and student collections alike.

SLOCUM, ROBERT B. Biographical dictionaries and related works: an international bibliography of collective biographies, bio-bibliographies, collections of epitaphs, selected genealogical works, dictionaries of anonymous and pseudonyms, historical and specialized dictionaries, biographical materials in government manuals, bibliographies of biography, biographical indexes, and selected portrait catalogs. Detroit, Gale Research Company (C1967). xxiii, 1056p. $20.

This bibliography, the first major one of its kind published this century, contains details of approximately 4,800 biographical dictionaries and related works published since 1500 about persons of note throughout the world. It is divided into three main sections:

1 Universal biography: publications which are not limited in time, place, or vocation of persons listed in them.
2 National or area biography: works published in 108 countries or areas throughout the world.
3 Biography by vocation: twelve major headings, some of which are divided into vocational subheads. The publications are arranged alphabetically by author; they are not first subdivided by country.

Works in foreign languages and those in English whose titles do not indicate their scope have descriptive annotations. There are comprehensive author, title and subject indexes.

Biographical dictionaries should prove to be a useful reference work.

LIST OF SHORT COURSES IN LIBRARIANSHIP AND INFORMATION WORK

COURSES WITH DATES SPECIFIED

Dates	*Subject*	*Total no. of days*	*Location and cost*	*For whom intended*	*Organization and Collaborators*	*Inquiries to*
*Sept. 4–5	Mechanized storage and retrieval of information on chemical structures	2		Technical information personnel	Postgraduate School of Librarianship and Information Science, The University, Sheffield	Dr M. F. Lynch, Postgraduate School of Librarianship and Information Science, The University, Western Bank, Sheffield, S10 2TN
Sept. 16–20	Survey techniques for librarians	5	Harrogate, *ca.* £5	Librarians	Leeds College of Commerce	D. Daintree, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
Sept. 17–20	Work in hospital medical libraries	5	London	Secretary-librarians	Aslib	Education Officer, Aslib
Sept. 19–20	Information for the construction industry	2	Liverpool	Librarians, information officers, civil engineers, management, others interested	College of Commerce, Liverpool	F. Gibbins, School of Librarianship, Dept. of Professional Studies, College of Commerce, Tithebarn Street, Liverpool 2
Sept. 23–27	Workshop on social science librarianship	5	Harrogate, *ca.* £8	Social science librarians	Leeds College of Commerce	D. Daintree, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1

Oct. 21–25	Introduction to Management for librarians	5	Medway and Maidstone College of Technology, Horsted, Chatham, Kent, 4 gns.	Qualified librarians	Medway and Maidstone College of Technology and library authorities in area	P. O. Hart, Principal Lecturer, Dept. of Management and Social Studies, Medway and Maidstone College of Technology, Horsted, Maidstone Road, Chatham, Kent
Oct. 23–24	Co-ordinate indexing for information retrieval	2	The Bell Inn, Aston Clinton (nr. Aylesbury), £21	All who are concerned with information retrieval	J. L. Jolley & Partners Ltd.	J. L. Jolley & Partners Ltd., Westbourne House, Westbourne Street, High Wycombe, Bucks.
Oct. 23–Nov. 13 (every Wed. for 4 weeks)	Music librarianship	4	Loughborough, *ca* £1 10*s*.		Loughborough Technical College	School of Librarianship, Loughborough Technical College, Radmoor, Loughborough, Leics.
Oct. 28–Nov. 1	Sound recordings in libraries	5	North-Western Polytechnic, London, £5 5*s*.	Librarians working or intending to work with sound recordings	School of Librarianship, North-Western Polytechnic and Sound Recordings Group, LA	Miss M. Miller, LRAM, ALA, Lecturer, School of Librarianship, North-Western Polytechnic, 207/225 Essex Road, London N.1
*Dec. 16–20	Scientific literature and its guides	5	NLL, Accommodation cost only	University Academic staff	NLL	Dr K. P. Barr, NLL
1969 Mar. 26–27	Co-ordinate indexing for information retrieval: a workshop and tutorial session	2	The Bell Inn, Aston Clinton (nr. Aylesbury), 20 *gns*.	Information officers		J. L. Jolley & Partners Ltd., Westbourne House, Westbourne Street, High Wycombe, Bucks.

* tentative

COURSES WITH DATES SPECIFIED—*continued*

Dates	*Subject*	*Total no. of days*	*Location and cost*	*For whom intended*	*Organization and Collaborators*	*Inquiries to*
April 21–25	Library techniques	5	Royal College of Nursing, London, 10½ *gns.*	Nurse tutors	Royal College of Nursing and National Council of Nurses of the United Kingdom	The Librarian, Royal College of Nursing and National Council of Nurses of the United Kingdom, Henrietta Place, London W1

COURSES WITH DATES NOT PRECISELY SPECIFIED

Dates	*Subject*	*Total no. of days*	*Location and cost*	*For whom intended*	*Organization and Collaborators*	*Inquiries to*
*Autumn 1968	Course for secretary-librarians in law libraries		£15 (including accommodation)	Part-time librarians in small law libraries	Leeds College of Commerce	D. Daintree, Esq., Dept. of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1
*Sept. 1968	Systems analysis	5		Senior library and information staff	Aslib	Education Officer, Aslib
*Sept. 1968	Literature of food and agriculture		London		Aslib	Education Officer, Aslib

*Sept. 1968	Information retrieval	5	Glasgow, £5	Staff of industrial and other special libraries	University of Strathclyde	Dept. of Librarianship, University of Strathclyde, Livingstone Tower, Richmond Street, Glasgow, C1
*Sept. 1968	Language dictionaries		London		Aslib	Education Officer, Aslib
*Oct. 1968	Course on patents		Liverpool		College of Commerce, Liverpool	B. Houghton, School of Librarianship, Dept. of Professional Studies, College of Commerce, Tithebarn Street, Liverpool 2
Oct. 1968 (ten evening lectures)	Special Library administration		Liverpool	Practising librarians and information officers	College of Commerce, Liverpool	F. Gibbins, School of Librarianship, Dept. of Professional Studies, College of Commerce, Tithebarn Street, Liverpool 2
*Oct. 1968	Introduction to mechanisation	5	London		Aslib	Education Officer, Aslib
*Oct. 1968	Senior introductory course	9	London, 25 *gns.*	Graduates in first year library science	Aslib	Education Officer, Aslib
Nov. 1968	Use of Biological Literature	3	Bradford, *ca* £3	Information scientists, university science librarians, new graduates about to start research	University of Bradford and NLL	Dr R. T. Bottle, University of Bradford, Bradford 7
Nov. 1968	Electrical Engineering and electronics	1	Kirkcaldy Technical College, *Nil*	Local industrial firms	Kirkcaldy Technical College	The Librarian, Kirkcaldy Technical College, St Brycedale Avenue, Kirkcaldy, Fife

* tentative

COURSES WITH DATES NOT PRECISELY SPECIFIED—*Continued*

Dates	*Subject*	*Total no. of days*	*Location and cost*	*For whom intended*	*Orgnaization and Collaborators*	*Inquiries to*
*Nov. 1968	Work study for librarians	5	Harrogate, *ca* £5	Librarians	Leeds College of Commerce	D. Daintree, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
*Dec. 1968	Classification systems	8	London		Aslib	Education Officer, Aslib
*Dec. 1968	Work with maps	2	London	Open	Aslib	Education Officer, Aslib
*	Social Science Literature	5	NLL, Accommodation cost only	University Research workers	NLL	Dr K. P. Barr, NLL
*1968	Series of Short Courses on the literature of various local government aspects	1	Leeds-Harrogate	Staff of departmental libraries within local authorities	Leeds College of Commerce	D. Daintree, Esq., Dept. of Librarianship and Information Science, Leeds College of Commerce, 28 Park Place, Leeds 1
*Jan. 1969	Report writing and preparation	5	Harrogate, *ca* £5	Librarians and information officers	Leeds College of Commerce	D. Daintree, FLA, Director of of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
Feb 1969	Management	1	Kirkcaldy Technical College, *Nil*	Local industrial firms	Kirkcaldy Technical College	The Librarian, Kirkcaldy Technical College, St Brycedale Avenue, Kirkcaldy, Fife

*Feb. 1969	Workshop on chemical librarianship	5	Harrogate, *ca* £5	Librarians and information officers	Leeds College of Commerce	D. Daintree, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
*Feb. 1969	Chemistry for chemical librarians	5	Harrogate, *ca* £5	Librarians and information officers	Leeds College of Commerce	D. Daintree, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
*Feb. 1969	Personnel management for librarians	5	Harrogate, *ca* £5	Librarians and information officers	Leeds College of Commerce	D. Daintree, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
*Mar. 1969	Workshop on standard specifications	5	Harrogate, *ca* £5	Librarians and information officers	Leeds College of Commerce	D. Dainrtee, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
*Mar. 1969	Abstracting and preparation of abstracting publications	5	Harrogate, *ca* £5	Librarians and information officers	Leeds College of Commerce	D. Daintree, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
*April 1969	Library planning and design	5	Harrogate, *ca* £5	Librarians and information officers	Leeds College of Commerce	D. Daintree, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1

* tentative

Annual Council Elections

The following are the results of the postal ballot counted on Tuesday 11th June 1968 at Aslib. 444 voting papers were received, of which twenty-one were invalid.

ELECTED		NOT ELECTED	
Candidates	*No. of votes*	*Candidates*	*No of votes*
Miss M. Webb	259	Miss A. M. Allott	164
Dr W. E. Batten	243	Mr H. H. Goom	157
Mr R. C. Wright	205	Mr B. T. Stern	146
Mr D. T. Richnell	204	Mrs K. Bourton	143
Mr J. R. Stocks	193	Mr J. L. Atkins	142
Mr W. L. Saunders	176	Mr D. Kennington	129
Mr G. Thompson	170	Mr W. H. Rutherford	126
Mr J. F. Blagden	167	Mr F. A. Graham	120
Mr L. G. Patrick	167	Mr R. Hindson	108
Mr J. S. Rippon	165	Dr H. V. Wyatt	101

Symposium on Toxicity

The impending changes in toxicity legislation in EEC countries and the increasing number of libraries and information departments which have to deal with questions of toxicity have stimulated the Chemical Group Committee to arrange a half-day symposium on toxicity, on Wednesday 9th October 1968, at 3 Belgrave Square, London, SW1.

The speakers will be from the British Industrial Biological Research Association—the body most capable of speaking on these matters. The first paper will deal with toxicity and the nature of the problems and a second will indicate how BIBRA information services go about answering inquiries. Ample time will be available for discussion and specific questions.

Since this symposium is of potential interest to the membership not normally associated with the Chemical Group an invitation is extended beyond the Group membership. Accommodation at Belgrave Square is, however, limited and those who wish to attend are requested to complete the application form enclosed with this issue of *Proceedings* and to return it not later than 23rd August 1968 to the Secretary, Mr A. R. Dodds, Information Officer, Porous Plastics, Dagenham Dock, Essex.

Work in Hospital Medical Libraries

A course for Secretary/Librarians on Work in Hospital Libraries will be held at Aslib from Tuesday 17th to Friday 20th September 1968. This course is intended mainly for unqualified persons who are in charge of small libraries or collections of medical literature in hospitals. The aim is to provide a basic training in the organization and management of such collections, as well as some knowledge of medical and general bibliography and of the resources available from outside bodies, as well as some instruction in handling inquiries. Many of the lectures will be combined with visits to medical libraries in the London area, and there will be come practical work. A programme of the course with application form is included in this issue. The fee for the course will be

10 guineas. Applications should be made on the form provided to the Education Officer, Aslib, 3 Belgrave Square, London, SW1. Intending students are advised to make early application. Provisional bookings will be taken by telephone or telex.

ASLIB RESEARCH PROGRAMME, 1969–71

THE Research Committee of Aslib has recently approved a programme setting out the broad objectives to be followed by the Research Department over the period 1969–71. The paper that follows summarizes the aims of research during the last five years, briefly reports on the progress made, and outlines plans for the future.

A. Research objectives, 1964–8

Early in this quinquennium Council decided to concentrate Aslib's research effort, laying greater emphasis on two lines of development: (*a*) the application of mechanical methods to library and information processes, (*b*) operational techniques in specialized libraries and information centres.

To explore the implications of this change the Information Committee of DSIR together with Aslib set up during 1965 a joint Working Party on the Aslib Research programme. The Information Committee noted that Aslib had to meet 'two equally important but somewhat conflicting needs—to increase its technical competence . . . so that it could provide an efficient and up-to-date advisory service as quickly as possible; and to make a substantial contribution to original research'.

The Committee recommended that Aslib research department should initially concentrate on meeting the first need. The Working Party's study of the implications of this resulted in programme recommendations that were summarized as follows:

A1 The Aslib research staff should become closely involved in the development and operation of mechanized information services. . . . In doing so Aslib should help to develop and improve techniques of evaluating mechanical systems.

A2 An expert group should be formed to see if a desirable optimized system can be designed. . . .

A3 Case material should be collected by systematic study of library operations and used in wide range of courses. . . .

A4 The possibility should be examined of a more general operational research study of library systems. . . .

While giving first emphasis to these developments, Aslib was encouraged by the Information Committee to continue to develop a programme of original research. These recommendations were accepted by Aslib Council.

B. Progress towards objectives

Since the Working Party reported, the following progress has been made on their programme recommendations.

B1 Aslib research department has been involved in mechanized information systems to handle (*a*) the computerized production of an abstracts journal, of bibliographies, of union lists, and of an index, and (*b*) the on-line computer control of library loan records. Four of these projects have included an economic evaluation of a mechanized system in relation to a conventional one. In a further project the department is undertaking a detailed systems analysis and costing of all clerical procedures in a university library, trying out an evaluation technique not previously used in the UK.

B2 Because information services are so varied a single optimized system is not likely to be achieved. Instead, the department is exploring two particular aspects of optimization: (*a*) the analysis of clerical procedures (see B1) is being extended to series of university libraries, to explore the extent to which a standard mechanized system could be introduced into this environment, and (*b*) the functions served by bibliographic records in a variety of libraries are being studied, as necessary background information to the design of a standard machine-readable record.

B3 Consultancies have provided case material on such themes as (*a*) library operations in a large scientific/technical research establishment, (*b*) information services needed by the head office of a large industrial concern, (*c*) the production of bulletins in an industrial library, (*d*) indexing problems faced by several types of service, and (*e*) the classification and coding of industrial products and processes.

B4 The department has begun systematically to explore library operations by O and M techniques, and to develop standard techniques of thesaurus construction.

B5 Aslib research in fields outside those studied by the Working Party has dealt with the following topics: (*a*) the needs and behaviour of information users—a wide sample of those using technical libraries, and a case study in depth of five individual users, (*b*) the use, as measured by citation, of the literature of science, technology and social sciences, and (*c*) the evaluation of individual indexing and abstracting serials.

B6 During 1968, (*a*) work on further mechanized systems is being undertaken, (*b*) the investigations reported in B2 have been extended, and in addition a study has been started of the use of simpler mechanized systems in special libraries, (*c*) O and M studies are planned to lead to standard times for library clerical operations and to comparative costs of alternative procedures, (*d*) a survey will be made of the regional distribution in the UK of potential users of scientific and technical information, (*e*) the information needs of metallurgists are being surveyed, and (*f*) experience gained in all this has begun to be passed on to information workers in courses such as the Working Party recommended.

C. Research department objectives, 1969–71

C1 The two objectives envisaged by the DSIR Information Committee in 1965 still remain primary: (*a*) to increase the department's competence to provide an efficient and up-to-date advisory service, and (*b*) to contribute to original research. The 1969–71 programme is designed to meet both needs. However, before presenting it, the scope of Aslib's interests must be outlined.

C2 Aslib is largely based on special libraries and information services. But the intermeshing of all phases of information transfer has increasingly led to Aslib's involvement, first, with general libraries (public, university, national), and second, with other information agencies (abstracting organizations, publishers). The library is a middleman in information transfer, and is consequently affected by problems arising at every stage of the process. Aslib therefore takes an interest in all problems of communicating specialist information.

The main aspect of communication with which Aslib is concerned is documentation. In this field there are four key functional units involved in the transfer of information from source to user—Publishing, Storage, Analysis and Search. Documents are multiplied and distributed by publishing units; they are housed and supplied on demand by library or storage units; catalogues, abstracts and indexes are prepared and distributed by analysis units; and in these guides documents are identified by search units (who may be individual users). Information transfers take place both between and within each functional unit.

C3 Two main types of problem are presented by the operations of information transfer.

(*a*) *Effectiveness*. We can ask, qualitatively and quantitatively, what is published and by whom, and do its content, form and availability meet user needs? What stores exist, and do their distribution, content and services meet user needs? What analytical guides exist, and do their availability, content and arrangement meet user needs? What search services exist, and do their distribution and output meet user needs? What new forms of publishing, storage, analysis and search output are needed? The documentation system is continually changing with time, and this dimension can be added to our questions—qualitatively and quantitatively, how are these outputs developing?

(*b*) *Efficiency*. Each operation includes four aspects: (i) physical elements such as media for recording information and machines for handling it, (ii) intellectual tools such as cataloguing rules and indexing vocabularies, (iii) personnel performing or controlling the operation, and (iv) its overall organization. For any particular operation, we can ask what physical and intellectual tools may be used, by what personnel, and how organized? What is the relative efficiency of each tool, person and mode of organization? What new tools, organizational modes and personnel are needed, and how can they be produced? Once again, we can add the time dimension—how are these operations developing?

The total activity of Aslib research department aims to explore both the effectiveness and the efficiency of information transfer. Its overall objective is to provide practical guidance to those who are planning developments in the communication of specialist information—whether at the level of the individual library or information service, at the level of a subject discipline, or at the regional or national level.

C4 The objective of increasing the research department's technical competence requires continued development along the lines set out in paragraphs B1 to B4. The essence of this area of work is the practical investigation of operating information systems, and the derivation of general principles.

(*a*) *Further involvement in the development of mechanized information operations*

For work of this kind Aslib needs the active co-operation of an operating organization that is undertaking such development, with Aslib staff participating in a preliminary feasibility study, in systems analysis and design, and in systems implementation. The results of such participation are threefold: (i) the co-operating organization is aided in its development, thus improving one element of the country's information system, (ii) Aslib experience is enriched, and (iii) data acquired during the investigation are of value in the research that will be described in C5 (*a*). The aim will be to gain experience in the mechanization of all the main operations of information transfer, extending the work summarized in paragraph B1. In particular, involvement will be sought in the following processes:

1. library acquisition procedures—mechanization of order processing, accessions processing, catalogue production;
2. serials processing in libraries;
3. retrieval procedures—the mechanical processing of queries against index files, both for current awareness (selective dissemination) and retrospective search;
4. integration of all library clerical procedures in a mechanized system;
5. mechanized transmission of all types of information—such as purchase orders, loan requisitions, queries, document analyses, and document texts.

We plan to be involved in at least six such operations during 1969–71, so as to have achieved technical competence in all the main operations of information transfer by the end of that period.

(*b*) *The development of optimized systems*

For this kind of work Aslib needs to investigate a series of examples of a particular system, in order to develop a common optimum. The result of such studies are those given in paragraph C4 (*a*), and in addition they will provide standard designs that can be adopted or adapted by new organizations with some confidence, thus reducing their development effort. Two types of system will be studied:

1. Clerical processes in university libraries—the continuation of work noted in paragraph B2. So far, two technical university libraries are being investigated, and we plan that a third university library will be studied during 1968. Our experience is that each library needs six man-months of Aslib senior staff time. Adequately to cover all types of university library, three more should be investigated, and we may then establish what common processes could optimally be standardized, and explore the possibility of an optimal mechanized system for them. This last phase of the research will be designed so as to take full advantage of other work carried out in universities and by computer usage groups.

2. Information services within a large, decentralized organization. An increasing number of organizations—industrial, governmental, academic—face the problem of providing a wide range of information services to

staff scattered throughout a decentralized organization. These services may be provided centrally, locally or by some combination of the two. Little data is available as to what combination is optimally effective and efficient, and how the optimum may be altered by mechanization. We plan to carry out two such investigations during 1969–71, the preferred fields of study being (i) the information services of a nationalized industry, (ii) the central and departmental libraries of a university.

(*c*) *Economics of library processes*

Libraries are subject to two pressures—a rising inflow of documents, and an increasing demand from users. The choice of procedures economic in staff, time or money is essential. We propose systematically to study a wide range of processes, and to evaluate the economics of alternative techniques. The needs of both large and small libraries will be taken into account. One aspect of this work will be to build up detailed knowledge within the department of equipment that may be used in libraries, its advantage and its costs. The results of this study will contribute to advisory work and to library systems design.

C5 The second area of work to be undertaken by the research department is that specified by DSIR Information Committee as original research. The essence of this is the investigation of problems common to many parts of the information system that cannot be studied simply by examining one or more operating systems. For 1969–71 four projects are planned.

(*a*) *General operational study of information systems*

An information system is the result of a hierarchy of decisions—who are the system users? What are their information needs? What formal services will be offered to them? Through what media will services be provided? How will these media be produced? At every point there are alternative answers to these questions.

The aim of the general operational study is to develop a 'decision tree' displaying the alternatives open at each level, and to assign to each alternative its cost and some measure of its effectiveness. If the cost and effectiveness of any particular set of decisions can be assessed, then an optimum set can be established. Decision trees will be developed (i) for particular system types, such as an industrial or academic institution, (ii) for particular user groups, defined by subject field, and (iii) for the national information system.

The results of this work will be twofold: (i) once developed and quantified, the decision tree will provide a means of assessing the cost and effectiveness of alternative system designs, and it should thus become a major tool in planning system development; (ii) the tree displays alternatives that must be quantified, and will thus in itself guide the research department as to what quantitative cost and effectiveness data needs to be collected—it will for example aid the planning of the research described in section C4 (*c*).

(*b*) *The study of information needs*

The first level of the decision tree is a statement of user needs, and until these are specified no rational planning of an information system can take place. Many user surveys have been carried out over the past twenty years, including work by Aslib. Most surveys have studied two extremes—either the needs of an individual organization, or of scientists and technologists as a whole. One result emerging from the studies is that certain factors are important in defining types of information environment—in particular, the nature of the institution in which the user works (e.g. academic or industrial), the nature of his job, and its subject field. What is now required are more systematic studies to explore these factors. The result of such research will be to provide planners with a clearer understanding of the needs that information services must meet.

The research department is conducting one such study in 1968, and we propose to carry out six further studies during 1969–71, choosing as subjects fields the major technological areas in which members of Aslib work.

(*c*) *The UK system of scientific and technical information*

The existing information system in this country represents one possible selection from the decision tree. It must be accurately described before the effect of any change can be evaluated.

Information is ultimately generated and used by individuals, but both production and use are institutionally organized. Many institutions initiate a flow of information (e.g. by publication) and users are located in other institutions. The intricate interlacing of information flows between individuals can be simplified and formalized by looking at the pattern of flow between institutions. If we are to affect this flow, we must first ascertain the present pattern. We propose to prepare a descriptive statement of the UK system.

(*d*) *The design of data systems*

At the present time, most operational information systems aim at 'reference retrieval'. The output is a bibliographic reference to a document that may be relevant to an inquiry. The inquiry is often for factual and perhaps quantitative data, but this must be extracted by visually scanning the document. The construction of systems that will provide data as an output is the next necessary step to aid the information search. We propose to carry out an investigation, theoretical in the first instance, to define (i) what types of data may need to be recorded in information systems, (ii) what types of data manipulation are needed, and (iii) by what methods may data be represented to permit these manipulations. The purpose of this research is to provide an essential background for the future design of data systems.

C6 To obtain the objectives set by the Information Committee the research department will allow for three other areas of work during 1969–71: (*a*) the use of its technical expertise in giving advice to members of Aslib, and carrying out paid consultancies, (*b*) the use of its expertise and case material in educational courses, and (*c*) short projects of various kinds.

EVIDENCE SUBMITTED TO THE NATIONAL LIBRARIES COMMITTEE*

SUMMARY

Aslib was invited to assist the Committee in the following terms:

> 'In particular, the Committee would value information and advice on the organization and role of specialist libraries. It would be most useful to know what co-ordination exists between specialist libraries and whether your Association regards this as adequate.
>
> Perhaps you would also like to comment on the role of a national library organization in the wider field of scientific and industrial information services. Does the future predict a growing importance for either regional libraries or a national library in meeting the information needs of the country, or should the Committee envisage information channels developing increasingly outside the network of library facilities?
>
> In addition to the above topics, the Committee hopes that you will feel free to comment as you would wish on any other aspects of the National Libraries Committee's task.'

The attached statement is accordingly in two parts, the first commenting on the points raised on behalf of the Committee, the second outlining views on the requirements for a National Library more specifically. The need to avoid excessive length in commenting on matters of considerable complexity has inevitably led in places to inadequate explanation of background. The following is a summary of the main points made in the statement.

Section A.1 There are 3,000–4,000 special libraries or information departments, including 1,450–1,500 concerned with science/technology in industry, Government and academic establishments, learned societies and other specialist organizations. They may concentrate on special subjects, collect material in special forms, serve special clienteles.

A.2 Special libraries are active service points, not only collections of literature, and they handle information in all its forms.

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* The creation of the National Libraries Committee was announced by the Secretary of State for Education and Science shortly before Christmas 1967. Its terms of reference are:

> 'To examine the functions and organization of the British Museum Library, the National Central Library, the National Lending Library for Science and Technology and the Science Museum Library in providing national library facilities; to consider whether in the interests of efficiency and economy such facilities should be brought into a unified framework; and to make recommendations.'

Its members are: Dr F. S. Dainton, Vice-Chancellor of The University of Nottingham (*Chairman*); Professor Sir Roy Allen, Professor of Statistics, London School of Economics; Mr T. G. N. Brown, Oxford University Press; Sir Bernard Miller, John Lewis Partnership; Professor David Talbot Rice, Professor of Fine Art, Edinburgh.

A.3 There are geographical and subject schemes for co-operation between special libraries. These are satisfactory in form but not in scale. Co-operation is discretionary and not easily systematized.

A.4 Special library and information services are closely inter-related and should remain so. There is a need for more centralized production of certain types of information services, and such 'bought-out' services could assist special library economics. The lending of identified documents can be most efficiently undertaken through a single large-scale warehousing unit such as the National Lending Library for Science and Technology. Reference services will be needed in the main centres of population. Over and above these services, there is a need for a National Library to ensure the collection and retention of the maximum possible amount of British and foreign literature. Referral services will be needed, possibly at centres of population but certainly at national level, to facilitate the most effective use of documentary and non-documentary sources of information in combination. Computer developments may affect this factor profoundly, but it is too early to be sanguine about these prospects.

Section B.1 Objective planning of a National Library is desirable but more evidence is required of user requirements and of the probable cost and effectiveness relationships of the possible organizational forms.

B.2 It is desirable for the National Library to give priority to acquiring, storing and making available all British print, and as much worthwhile foreign print as possible, and on developing location and loan facilities.

B.3 A single National Library Administration is required for the Library Departments of the British Museum, the National Reference Library of Science and Invention, the National Lending Library for Science and Technology and the National Central Library. The Administration should be visualized as a sub-unit of a future National Information and Library Authority, probably funded by the Department of Education and Science, but representative of both public and private library/information interests.

B.4 There are four priority tasks which the National Library Administration should undertake while examining its longer-term organizational problems.

B.5 While circumstances may rule out a unified lending/photocopying and reference facility in London, the relative economics of a dual and a unified system are unclear, and should, if practicable, be investigated.

B.6 The reference facility must be in Central London. But more needs to be known about the lending/reference relationship, and about the degree of contiguity needed between disciplines in the reference facility. It would be realistic to assume that the literature of all disciplines needs to be housed together on a single site for efficient reference purposes.

B.7 A referral service and the British National Bibliography could operate most efficiently if accommodated alongside the reference facility in London. The National Library should make a specific contribution to training, and should serve as a test-bed for the study of operational systems. This, and the referral function, would indicate the logicality of planning to accommodate Aslib also on the London site.

B.8 In spite of the questions which cannot be resolved at present, it is hoped that their very existence will be a challenge to plan the National Library with reference to objective standards, many of which, it is acknowledged, have still to be determined.

* * *

INTRODUCTION

This document consists of two parts. Section A deals with the general matters on which Aslib's views were invited by the Secretary of the Committee. Section B contains more specific comments on the requirements for a National Library.

SECTION A: ROLE AND ORGANIZATION OF SPECIAL LIBRARIES AND INFORMATION SERVICES

1. Numbers and Locations of Special Libraries

For convenience, the term 'special library' will be used generically in this document, though it will be appreciated that, particularly in industry and in organizations related to industry, the distinction between special libraries, information services, information departments and intelligence departments is frequently a verbal distinction only. Special libraries are to be found in private and nationalized industries, Government departments and research establishments, specialist academic institutions, learned societies and a variety of other specialist organizations such as research associations, banks or political organizations. Aslib is concerned with all of these regardless of subject coverage, though for historical reasons it has been most active in the twin spheres of industry and Government, with major emphasis on science and technology and the social sciences related thereto. It is also concerned with the specialized services, mostly technical and commercial provided by the larger public libraries, but these will only be dealt with incidentally in this particular document.

The number of special libraries in the United Kingdom cannot be stated with certainty but, as a guide to the extent of their role, two figures may be usefully mentioned:

(*i*) The 1957 edition of the *Aslib Directory* (to sources of information in Great Britain and Ireland)—the latest to be compiled on an all-subjects basis—was compiled from replies to questionnaires circulated to 'some six thousand libraries and other organizations capable of providing specialized information', of which some 3,300 were eventually included. The number of such establishments has certainly increased since 1957, probably quite substantially.

(*ii*) Specifically in science and technology, 1,459 special libraries were positively identified in January 1965 in England, Scotland and Wales as a by-product of an Aslib research project, as follows:

Firms	509
Government Establishments	228
Technical Colleges and C.A.T.S.	238
Learned Societies	182
Universities	170
R. & D. Associations	132

The 'special' element in a special library may consist of one or more of the following:

it may concentrate on one or more special subjects, e.g. mineralogy or psychology and their fringe fields;

it may collect material in a special form, e.g. computer tapes or film stock shots;

it may serve a special clientele, e.g. a firm's research and development staff or the membership of a scientific society.

2. The Role of Special Libraries

Special libraries range in size from one-man units to large libraries employing fifty or more persons. At one end of the scale their function may be limited to acquiring literature and making it available on demand or circulating it to individuals in accordance with known interests; at the other it may include abstracting, translating, collection and collation of information from many sources, its evaluation and interpretation in terms of known policies, and its dissemination via news bulletins, abstract bulletins, exhibitions or other media. The three basic functions common to virtually all are:

(*i*) to select, acquire and make available to authorized users documents related to the main subject interests of the parent organization and to obtain such other documents as may be required from time to time;

(*ii*) to provide current awareness services to assist users in keeping themselves informed of new developments within their fields of interest;

(*iii*) to provide information in response to inquiries.

Special libraries tend to acquire and keep only those documents—and journals, research reports, company reports, monographs, patents and standard specifications often heavily outnumber books—for which there is likely to be a regular demand; other material is consulted, photocopied or borrowed as necessary, and this requires staff with a detailed knowledge of the scope and holdings of other specialized libraries. In addition, since few special libraries deal exclusively with recorded information, their staffs need as far as possible to have means of ascertaining work in progress at other centres likely to be of interest to their parent organizations. In consequence, one important feature is the extent to which personal contacts—often quite informal—are developed with other organizations which may or may not be, or possess, libraries in the conventional sense. These contacts are often established through the assistance of a third party such as Aslib, which has extensive specialized knowledge of sources of information. In all such contacts it is, of course, necessary to recognize the restrictions imposed in certain fields by commercial secrecy or other considerations.

3. Co-operation between Special Libraries

It follows from the preceding paragraph that co-operation between special libraries is highly developed, though it is frequently not highly formalized. The main reason for the relative absence of formalism is that each special library, being set up to serve a particular clientele—which (e.g. in private industry, a scientific society or a research association) is usually responsible for financing it—has a primary responsibility towards its parent, and co-operation must therefore be a discretionary matter. However, not all special libraries are in this position. For example, the special library of a research institute of a university clearly has a prime responsibility to the staff of its institute, but is nevertheless financed from public funds.

Many special libraries are members of one or other of the Regional Library Systems. In addition, facilities exist for co-operation on both a geographical and a subject basis.

(*i*) *Geographical basis*

There are at present forty-one local co-operative schemes, and these are listed in Appendix I. Each includes libraries of different types, such as industrial, technical college, society libraries, and is usually based on a large public reference library which is responsible for administering the scheme. The main advantages of such schemes are that:

they enable the local interchange of documents to take place speedily and with a minimum of formality;

they are closely related to local needs, since the constituent literature collections tend to reflect local interests and activities;

they enable small specialist organizations, usually with limited budgets, to obtain access to material, e.g. reports, lesser-known journals, not readily available from public sources;

by co-ordinating holdings in the area, they permit specialized libraries to make the most economic use of their resources by concentrating expenditure on their special subject(s), whilst placing at their disposal an extensive reservoir of other information in case of need.

Against these must be set certain disadvantages:

because of geographical limitations, many subject fields may not be represented in a given scheme;

changes in the local government policy can have substantial influence, since the success of each scheme depends considerably on the effectiveness of the administrative centre and the funds available to it.

(*ii*) *Subject basis*

Aslib itself includes in its membership special libraries in virtually every subject field and, in addition to acting as a referral centre on a national scale, promotes co-operation in the use and development of library services, in training and in research in library and information work and provides a range of supplementary co-operative services. These include a location index of translations, panels of indexers and translators, locating and copying services, and a technical inquiry service. This latter has a particular advantage, since many companies are prepared to disclose their interest to Aslib when they are not willing to disclose it directly to another private or a public source of information. In addition, co-operation within particular subject fields is facilitated through the Aslib subject groups which at present cover aeronautics, biology, chemistry and chemical technology, criminology, economics, electronics, engineering, textiles and transport. These groups provide mechanisms for the exchange of technical or other specialized information within subject fields, and also act as forums in which problems related to the supply or organization of information peculiar to an industry or a discipline can be examined.

(*iii*) *Adequacy of co-ordination*

Unlike the public libraries and, to some extent, the more general academic libraries, special libraries are in almost no sense homogeneous; each is 'special' to its own situation.

They do not, therefore, fit easily into a predetermined pattern or system and, since they usually deal not only with documents but with information in whatever form, inter-communication is in general less easily systematized than in libraries where the lending/borrowing of an identified document is the principal form of co-operative activity. The essential requirements are flexibility and ability to make personal contact. In this context, the present *forms* of geographical and subject co-operation are probably adequate for present and foreseeable needs, but neither is wholly satisfactory. In the case of the local schemes, there are clearly areas which still have no co-ordination and could benefit from such a development. In the case of subject co-ordination, the only referral centre established with the aim of putting seekers of information in one discipline in touch with specialized knowledge in any other discipline is the one operated by Aslib's information department and, in broad outline, codified in the *Aslib Directory*. In its present form, whilst it has material and expertise to operate on a much larger scale, it is in principle usable only by member organisations of Aslib (which may or may not be a sizeable percentage of potential users), and it is not, at present, funded in such a way that it can provide a genuinely national service. This is a highly specialized operation and Aslib would welcome the opportunity of making its expertise more generally useful.

Under present conditions, it would seem that co-operation of this kind could not be satisfactorily replaced by a central library service, however comprehensive its stock or however efficient its internal operation. In industry especially, speed of service is of primary importance and it is sometimes claimed that even that of the NLLST is not fast enough for optimum industrial use. In the short term, it is difficult to envisage a central service such as the NLLST operating by methods other than systematic use of standardized stationery (itself a subject that could benefit from investigation) following predetermined procedures. However, where local and subject co-operative schemes are involved, a telephone call can dispense with a requisition form, the availability of help or otherwise can be established at once and, frequently, the problem behind the inquiry can be clarified by discussion, either with the librarian or with a specialist on another telephone extension. Such speed and flexibility clearly have advantages that are difficult to reproduce in a large-scale organization employing existing methods.

4. Future Pattern of Information Services

Because of the paucity of hard facts about the operation and use of library and information services, it is almost impossible to predict the future pattern of their development.

Although the number of useful studies and experimental services in this field is increasing steadily, it is probable that a good many more years will be required before anything approaching scientific planning on a national scale can be undertaken and, in ideal circumstances, it would of course be desirable to plan the services and operation of a National Library as an integral part of a planned national library and information system. Since that cannot be done, there will clearly have to be many compromises. However, some comfort can perhaps be taken from the fact that, whatever its shortcomings, the present scheme of things has developed in response to certain needs, however imperfectly expressed or understood. Unless and until there is evidence to the contrary, therefore, the objective is likely to be fundamentally similar to what exists now, but the present scheme should be capable of improvement and rationalization by the application of new skills and knowledge to which libraries and information services generally have only recently been exposed, including operations research and mechanical and electronic methods of manipulating data and information. It is reasonably certain that the printed word or other visual image will retain their place in society as one of the two basic means of communication, and that, unless phenomenally cheap methods can be developed of recording enormous quantities of information, finding specific items of it again on demand and reproducing them in readable form within the briefest space of time, actual documents are likely to remain the cheapest, most compact, mobile vehicles for communication, involving relatively small capital investment and little maintenance.

It will be appreciated, in view of the foregoing, that what follows must necessarily be largely speculative. It is also mainly informed by experience with subjects and services related to industry and commerce, particularly science, technology and certain of the social sciences. The role of literature in the humanities is thought to be different, in that it most frequently represents the basic material of study whilst elsewhere it serves mainly as a catalyst. However, still less is known about this field than about science and the social sciences, and it is not claimed that identical considerations will apply. With all these reservations and provisos, Aslib considers that the following constitute reasonable and justifiable speculation about the future:

(*i*) Both libraries and information services in some form will continue to be required and will continue to operate in close relationship with each other. This semi-integration is, incidentally, one aspect of the British information scene which is widely admired and envied in other countries and attempts are being made, e.g. in Germany, to follow a similar pattern. There may, of course, be changes of emphasis in the relationship.

(*ii*) Special libraries will not revert to the passive role of acquisition, storage and accessible arrangement of literary material which characterized 'classical' librarianship for centuries. The role of a special library as a centre for the provision not only of literature but also of information and of related services is well established in industry and in Governmental and other establishments serving industry, and there are growing tendencies towards a similar development in specialist academic institutions.

Any change in emphasis in special libraries is likely to be still further in the direction of increasing the number of specialist persons, rather than the amount of specialist literature, and there will be increasing need for people capable of operating and exploiting computerized information services, of evaluating and interpreting information in the local context, and of participating in policy decision-making.

(*iii*) The costs, especially manpower costs, of individual special libraries are high, and the acquisition, recording and storage of a large proportion of information are duplicated in many places. Theoretically, substantial savings could be made if some of this effort could be centralized, e.g. once per subject or once per industry.

(*iv*) Centralized services for dissemination purposes (current awareness, selective dissemination, etc.) are unlikely to be wholly library-based. Clearly the basic raw material will be mostly library material, but this must be selected, evaluated and interpreted by people engaged in the subject and this presupposes an active centre of research. Each centre with a dissemination function—whether discipline-based or industry-based—would therefore need to have a library as part of its dissemination mechanism, but it is possible that this could be kept within the limits required to service the research and information staff of the centre, and to make available specialized documents not easily accessible elsewhere; it need not necessarily be built up to the extent needed to give a comprehensive loan service to the recipients of the centre's information services, and indeed the conflicting requirements of two separate clienteles may well mean inadequate service for both.

(*v*) The storage of documents for loan could probably be undertaken more economically elsewhere, also on a centralized basis. But whereas many centres for the dissemination of information would be required—according to a given pattern of subject or industry division—the number of document storage centres from which loans of *identified items* would be made could be very small. Thus the number of copies of a document to be filed and lent, taking the country as a whole, could be reduced but, even more important, so could the records associated with their acquisition and loan. The satisfactory record of the National Lending Library for Science and Technology to date supports this approach at least for scientific literature. A warehousing function like that of the NLLST is largely a matter of scale and organization and there is probably no insuperable reason why a single national store should not suffice for all subjects. If so, Boston Spa would be the obvious choice. A rationalization of stocks of publications on this scale may, of course, have serious implications for specialist publishing, and this aspect of the problem would need to be examined.

(*vi*) Reference services present a more intractable problem. First, it is inconceivable that a single reference library could cope physically with the entire national need for reference services. Secondly, while most users will travel almost any distance to consult essential material occasionally, it is improbable that they would be prepared to travel more than about one hour each way with the frequency necessary for many user categories. This suggests that extensive reference facilities will be needed to serve all the main centres of population, their location to be determined on a demographic, rather than a regional, basis; how far existing publicly financed libraries of various kinds could be developed to provide adequate coverage and freedom of access would need to be investigated. Clearly, it would be impossible and undesirable for them to become National Reference Libraries in miniature and their stocks would presumably reflect in large measure the interests of the communities they served. For maximum efficiency, they would not normally combine lending and reference functions, but the relationship between the two could be investigated with advantage. For example, certain categories of material not used frequently might serve both purposes.

Over and above the service which this category of reference library could reasonably be expected to give, there ought to be a single library at which any reader from any part of the country could be certain of finding and consulting virtually any known document, whether British or foreign in origin. This is essentially the task of a National Library and, in some degree, the comprehensiveness of its foreign material could be regarded as almost more important than that of its British material. However, realism suggests that even here compromise cannot be avoided and for some categories of foreign material it would surely suffice if a reader could establish with certainty that the documents he wished to consult could be at his disposal, from an overseas source, within days rather than weeks or months.

(*vii*) It is a laudable aim that an inquirer should be able to put his questions directly to a specialist centre. Provided he knows the appropriate centre, there is no problem, and if both inquirer and centre command suitable computer facilities, it is theoretically possible to obtain the answer either at once or as a result of a dialogue between inquirer and computer store.

In principle, there would seem to be no insuperable technological barrier and, in the case of certain types of information, of which numerical data is the most obvious, this may well be feasible even on an international scale. Most other categories of information, however, pose semantic and similar problems connected with the analysis of content, its committal to store and subsequent retrieval, which are still very far from solution. It is proper in the present state of knowledge that solutions to these problems should continue to be sought, but it may well be that simple economics will eventually be the deciding factor. At the moment, there is little doubt that if a document exists which adequately answers an inquiry, and if it is readily available, this is on a true cost basis the cheapest way to provide the answer—and computer costs would need to be tremendously reduced to compete.

The experience of the Aslib information department, certainly not conclusive, suggests that a very high proportion of inquiries can in fact be dealt with adequately by a document or documents. If this is generall true, an inquirer who does not know the correct subject source should clearly aim his inquiry first at his nearest reference library, which would need to be equipped with both records and personnel capable of indicating promptly where the utility of documents ended, so that the inquirer could then be switched to the appropriate information centre. Eventually, if communications and index-searching by computer can be speeded up sufficiently, the delay factor in referring an unsatisfied inquiry to a National Library should be virtually eliminated and it would then be logical to maintain a switching mechanism (i.e. a referral centre) only at the National Library. This referral centre would, of course, serve double duty as a switch from one organizational source to another when required.

SECTION B: THE NATIONAL LIBRARY

1. Introduction

Aslib welcomes the decision to examine the functions and organization of those libraries which at present fulfil a national role, not only because their haphazard growth, the unequal financial provision made for them and, most of all, the lack of cohesion in their administration appear to prevent the operation of an efficient national service now and the planning of such a service in the future; but also because it should now be possible to make the dispositions necessary for a long-term solution based on facts and on research into user requirements and the cost/effectiveness ratio of possible alternative organizational patterns.

2. Functions of a National Library

The essential functions of a British National Library are, in Aslib's view:

(*i*) to acquire the whole of the British production of printed material (including semi-published and unpublished material whenever possible) and the maximum possible amount of foreign material, and to maintain

them for convenient use by reference in situ or by lending; and
(*ii*) to serve as a national centre for the location and, if necessary, loan of material from other British or foreign sources.

The latter requirement underlines the importance of a major degree of integration of the National Library with other library services of all kinds. Although it is possible to postulate other functions for a National Library, such as the production of a national bibliography, Aslib considers that the two functions described above are fundamental and that the development of adequate machinery to perform them efficiently under a unified administration should be the first priority. Most of the additional functions usually suggested are, in any event, also highly specialized in their various ways and can perhaps be performed more efficiently by specialist units working in association with the National Library. Indeed, it is clear that, in view of the paucity of relevant facts now available, it would be unwise to attempt to draw firm conclusions about all the necessary long-term operational dispositions until a unified administration has been created and is in a position to undertake or commission the necessary investigations. In spite of this, it is recognized that practical considerations may rule out any significant delay with regard to one fundamental factor, namely the question of a site or sites, and some observations on this point are offered in para. 6 below.

3. Need for Unified Administration

In Aslib's view, therefore, the first, essential and urgent step is to place the Library Departments of the British Museum (including Prints and Drawings and the National Reference Library of Science and Invention), the National Lending Library for Science and Technology and the National Central Library under a single administrative body. The Science Museum Library should not be included. The 'national' role which it has filled since the time of Bradford came to it fortuitously and it is more appropriate to regard it as a special departmental collection, devoted to the history of science and intended primarily for the staff of the Science Museum, but available for reference purposes to the serious student on the same basis as most other Government departmental collections. At the same time, its service to Imperial College will presumably continue since it appears to satisfy both parties, even though the arrangement appears somewhat anomalous.

It is recognized that the position of the Library Departments of the BM presents certain difficulties. It would seem that, as things now stand, their holdings cannot be integrated into a full National Library service divorced from the collections of antiquities; equally, that a National Library service would be incomplete without them.

On the face of things, there would appear to be no great advantages in the continued administrative linkage between the collections and the library departments. However, if there is evidence to show a substantial degree of reliance upon the library departments by the staff or users of the other departments of the Museum, this would be one factor to take into account in determining the location of a National Library, but Aslib has no means of knowing the extent of such use.

It is a matter of opinion whether the National Library Administration (for want of a better term) should form part of the executive arm of Government or be independent of it. There are clear advantages and disadvantages in either arrangement. However, the time would seem ripe, and the matter of sufficient moment, for a more long-term examination of the future pattern and administration of library and information services generally, and the nature of the National Library Administration would need to be such that it could fit easily into the ultimate pattern.

The DES has, in a relatively short time, concentrated within itself responsibility for a wide variety of library and scientific information services. Nevertheless, this has been, and is probably bound to be, accompanied by further fragmentation of responsibility within the overall library and information field, e.g. by the growth of a major information activity in the Ministry of Technology. Other major Ministries are likely to become progressively involved as the experience and lessons of science and technology are absorbed into the 'useful' social sciences, e.g. economics, marketing and management sciences. In addition, it must be remembered that a great variety of both private and public bodies share responsibility for the diverse library services that the nation needs, and that such extensive and complex services could not, and should not, be a function of central Government alone. Probably the most effective administrative form in such a situation would be a statutory authority, e.g. a National Information and Library Authority, responsible for the oversight and co-ordination of all the nation's activities in the library and information field. Such an authority would draw its funds and authority from a single Ministry, probably DES, but other Ministries with a major information/library responsibility would have representation on it, as would the principal non-Governmental library interests. Aslib would hope to see the National Library Administration as a sub-unit of such a National Information and Library Authority, and would expect it to have a strong bias in its composition towards the main classes of users of a National Library Service, including especially representatives of the *libraries* which use a National Library Service.

4. Immediate Tasks for National Library Administration

It is envisaged that the first tasks for the new Administration would be:

(*i*) to ensure the collection of all new British material and the maximum of foreign material in all subjects, with a view to making the eventual stock of the National Library as comprehensive a collection of world literature as is humanly possible;

(*ii*) to determine the scope and coverage of each of the constituent libraries and to harmonize their operations and procedures where possible pending a decision on the eventual pattern of the National Library;

(*iii*) to establish adequate arrangements for the location and loan of identified items, whether from other UK or from foreign sources;

(*iv*) to ensure the existence of adequate referral facilities capable of acting as a transfer mechanism between the National reference services and specialized sources of information. It has been suggested, e.g. in the Library Association report on Scientific Library Services, that it would be appropriate to develop the referral service provided by the Information Department of Aslib, and reflected in the *Aslib Directory to Sources of Specialized Information*, into such a national referral service possibly located at the National Library, and this would offer a useful capitalization of Aslib's resources and experience;

(*v*) to determine the long-term pattern of the National Library.

5. Lending/Reference Relationship

Aslib does not believe that it is possible to say with certainty at this stage how a National Library should eventually be organized. In science/technology, the assumption has been that separate arrangements need to be made for the lending and reference functions. But with high-speed, low-cost reproduction facilities, it is not certain that two separate establishments and costly staffs are necessary, though the limitations which copyright places on the photo-copying of many categories of documents add a further factor which needs to be taken into account. In principle, an assessment ought to be made of the relative economics of a dual and a unified system before any final decisions are taken. It may be, of course, that it is not practical to treat this as an open question: site availability and site costs in central London compared with the provinces, and the existing investment in Boston Spa are such that only mammoth savings in future operating costs could justify a major reversal of policy at this stage. Nevertheless, the question is both real and disquieting.

6. Site Requirements

The need for easy accessibility from all parts of the country and from overseas, and the pattern of public transport, unquestionably indicate a site in London for the entire library in the case of a unified system, or for the reference function in the case of a dual system. More specifically, it would seem logical, from what is known about the major user groups of existing services, to aim at a site convenient to the main railway termini of Euston and Kings Cross, to the patent agents and associated users in the Chancery Lane/Holborn area, who represent some 40 per cent of the use of the NRLSI, and to the academic community centred in and around Bloomsbury. If studies point to a dual system, there would appear to be every advantage in concentrating the lending function at Boston Spa, probably for all subjects but at least for the natural and social sciences and technology.

The development possibilities in London will clearly be influenced for good or ill by the size of site that can be procured, and the intensity of development that planning requirements will permit upon it. It is generally assumed that reference across disciplinary boundaries is extensive and that the literature of all disciplines ought, therefore, to be housed in close physical proximity. Certainly this is an ideal which has many advantages at least in theory, but in practice the extent of contiguity that is necessary is unknown. Only a reliable quantitative assessment of this problem could help to determine the site area that will be needed, since (*a*) if the inter-disciplinary factor is high only a very large site adequate for the literature of all fields will be likely to permit the development of an efficient service, whilst (*b*) if it is low, a greater or lesser degree of fragmentation (which itself will need to be assessed systematically) could be contemplated. Unfortunately, past records would not necessarily provide a reliable indication since a variety of apparently extraneous factors, such as standards of indexing, could seriously affect the figures.

Notwithstanding these considerations, the site question is clearly of such urgency that a decision, however imperfect or pragmatic, must be taken without delay and, in these circumstances, Aslib would unhesitatingly advocate the acquisition of the largest possible site in central London on the assumption that at least the reference and related facilities in *all* subjects should be housed together on a single site. It would do so primarily because it believes that, whatever past indications may be, reference across disciplinary boundaries is considerable and is likely to increase rather than diminish. It also recognizes that, unless a site of such magnitude were adopted as the aim, it would never be possible subsequently to accommodate the literature of all disciplines together, no matter what evidence to that effect might later be established. Conversely, if the premise of growing inter-disciplinary traffic were later nullified, any part of the central site not required for the National Library proper could be put to good use—not least, perhaps, in establishing a national library and information precinct in the heart of the capital to house, alongside the National Library, the principal organs of planning and research for the nation's library and information activities.

7. Associated Activities

Mention has already been made of the desirability of locating a referral service alongside the National reference services. It would also be appropriate for the British National Bibliography, which depends upon the National Library's intake for its raw material, to be physically close to the library. In addition, the National Library itself ought to be in a position to make some contribution to the national training effort, possibly most effectively in providing training in the use of specialized literature. Finally, the National Library system as a whole, and especially the reference centre, should serve as a test-bed for the study and development of operational systems, including mechanized systems, and it would therefore be an efficient use of resources to provide on the site for the accommodation of Aslib which is, in agreement with OSTI, concentrating its R & D programme on these aspects.

8. Conclusion

Aslib is well aware of the inconclusive nature of much that is contained in this document, and very much regrets that more positive recommendations cannot be put forward over the whole area covered by the Committee's inquiry. In the absence of more extensive and substantial evidence, however, it believes that the best service that it can offer is to pinpoint those aspects where reasonable immediate decisions seem possible and indeed necessary, and, for the rest, to invite attention to the principal problems for the solution of which further investigations appear desirable. This it has attempted to do in the hope and belief that the National Library of the future will be a product of rational planning in terms of both user requirements and of economics.

APPENDIX I: LOCAL CO-OPERATIVE SCHEMES

Bath and District.
Berkshire Libraries Group
Birmingham and District Technical Periodicals Interchange Scheme.
Birmingham Works Libraries Loans Scheme.
Bradford Scientific, Technical and Commercial Service (BRASTACS).
Canterbury Circle of Librarians.
Coventry and District Information Group (CADIG).
Dorset Co-operative Scheme.
Essex Technical and Commercial Library Service.
Fleetwood and District.
Gloucestershire Technical Information Service (GTIS).
Halifax and District Information Service (HALDIS).
Hampshire Technical Research Industrial Commercial Service (HATRICS).
Herefordshire Co-operation Scheme.
Hertfordshire County Council Technical Library and Information Service (HERTIS).
Huddersfield and District Information Service (HADIS).
Hull Technical Interloan Scheme (HULTIS).
Leeds Co-operative Scheme.
Leighton Scheme.
Libraries of North Staffordshire in Co-operation (LINOSCO).
Library and Information Service for Tees-side (LIST).
Liverpool and District Scientific, Industrial and Research Library Advisory Council (LADSIRLAC).
Luton and District Information Service.
Manchester Service to Industry.
Mid-Staffordshire Libraries in Co-operation (MISLIC).
North-east Lancashire Libraries.
North Hampshire Sub-Regional Co-operative Scheme.
North Wales Urban Libraries Group.
Nottingham and Nottinghamshire Technical Information Service (NANTIS).
Paisley and District Technical Information Group.
Preston and District Commercial and Technical Information Services.
Sheffield Interchange Organization (SINTO).
Swindon Area Association of Libraries of Industry and Commerce (SAALIC).
Thurrock Co-operative Scheme for Local Industry.
Tipton Co-operative Scheme.
Tyneside Association of Libraries for Industry and Commerce (TALIC).
Wandsworth Public, Education Technical Library Service (WANDPETLS).
West London Commercial and Technical Library Service (CICRIS) (formerly Co-operative Industrial and Commercial Reference and Information Service).
West Sussex Technical Library Service.
Wiltshire Association of Libraries of Industry and Commerce (WALIC).
Yorkshire Cobook Group of Libraries.

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Developments towards a computer-based information service in physics, electrotechnology and control, by T. M. Aitchison, M. D. Martin and J. R. Smith. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.177–86. A research and development programme is discussed which is required for the mechanization and expansion of the services provided by the IEE's INSPEC Organization. Paper presented to 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August 1967.

ÁKOS, TEREBESSY
A Koreai Népi Demokratikus Köztársaság Tudományos és Müszaki Tájékoztatási Központja és Tevékenysége [The Scientific and Technical Information Centre of the Korean People's Republic and its activities]. *Tudományos és Müszaki Tájékoztatás,* vol.15, no.2, February 1968, p.119–21.

ALL change at the Museum. *Nature,* vol.218, no.5144, 1st June 1968, p.801. Comments on the appointment of Sir John Wolfenden as Director of the British Museum.

AMSDEN, DIANA
Information problems of anthropologists. *College and Research Libraries,* vol.29, no.2, March 1968, p.117–31. Discusses the background problems of anthropologists, the character of their discipline and the consequences of this character for the arrangement and cataloguing of anthropological literature in the library.

ANDERSON, J. W.
Improving the validity of comparative technical library statistics. *Special Libraries,* vol.58, no.10, December 1967, p.697–702. A comparison of published and unpublished statistics on staff, space, and costs of special libraries has led to three graphs which relate these aspects to the number of potential users.

ANNAN, GERTRUDE L.
The total library. *Bulletin of the Medical Library Association,* vol.56, no.2, April 1968, p.119–22. The Medical Research Library of Brooklyn serves the needs of the immediate area by sharing resources, use of its computerized programme, and participation in a state-wide system.

ARMITAGE, JANET E., *and* LYNCH, MICHAEL F.
Some structural characteristics of articulated subject indexes. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.101–11. A simple model has been devised for the generation of articulated subject index entries from natural language indexing phrases which exclude infinitives or words acting as gerunds or participles. Paper presented to 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August 1967.

ARMSTRONG, ALAN
Pooled knowledge the only hope. *New Scientist,* vol.38, no.600, 6 June 1968, p.516–17. Emphasizes the need for national bodies to integrate effort in specific fields to avoid unnecessary duplication.

ÁRPÁD, ARANYOSSY
A KGST országok együttmüködése a müszakigazdasági tájékoztatás tökéletesítésére a szinesfémiparban [Co-operation among the CMEA countries in improving technical and economic information in the non-ferrous metal industry]. *Tudományos és Müszaki Tájékoztatás,* vol.15, no.3, March 1968, p.202–7.

ATKINSON, G.
County technical library services. *CADIG Newsletter.* vol.11, no.2, June 1968, p.3–9. Outlines several co-operative schemes, like HERTIS, NANTIS, and examines in details the system operating in Northamptonshire.

BARNHOLDT, B.
Mechanisierung der Kataloge einer wissenschaftlichen Bibliothek [Computerization of the catalogues of a scientific library.] *Nachrichten für Dokumentation,* vol.19, no.3, April/May 1968, p.67–76. Using the Danish Technological Library as an example, the author describes and illustrates the possibilities of mechanizing various processes such as acquisition, cataloguing and circulation.

BARTFAI, IMRÉNÉ
Systém výuky technických knihovníků a informačních pracovníkě v MLR [The educational system for technical librarians and information workers in the Hungarian People's Republic]. *Metodika a Technika Informaci,* no.11, 1967, p.21–3. History of education is outlined.

BELLREL a computer-aided loan system. *ALA Bulletin,* vol.62, no.4, April 1968, p.407–8. Bell Telephone's real time computer system for handling transactions in a library network has gone into operation.

BLOOMEFIELD, MASSE
Cost characteristics of library service. *Special Libraries,* vol.58, no.10, December 1967, p.686–91. A survey in 1966 of nine aerospace libraries' collected data on four characteristics of their operation; (1) circulation, (2) library staff, (3) people served, (4) library space. The total operating costs of each aerospace library was estimated.

BLUM, VÉRONIQUE
Les bibliothèques des centres hospitaliers et universitaires. *Bulletin des Bibliothèques de France,* vol.13, no.2, February 1968, p.59–76. Discusses medical school libraries in their wider context of medical school reform both in Paris and the provinces.

BORKO, H.
Informationswissenschaft: Was ist das? [Information Science—What is it?] *Nachrichten für Dokumentation,* vol.19, no.3, April/May 1968, p.59–61.

BREARLEY, ANNE
An organization for Canadian special librarians? *Canadian Library,* vol.24, no.4, January 1968, p.333–7. Discusses the need for a separate organization to represent the special librarian in Canada. The possibilities of an organization within SLA or CLA are also considered.

BURNS, RICHARD K.
The National Advisory Commission [on Libraries]. *Library Journal,* vol.93, no.9, May 1st 1968, p.1859–64. Describes how and why the Commission was set up and the way it approached its assignment.

CASTLELAIN, RAOUL, *and* ROUANET DE VIGNE-LAVIT, ANDRÉ
Les disques et le référé [Gramphone records and summary procedure]. *Revue Internationale du Droit D'Auteur,* vol.56, no.7, April 1968, p.40–81. Examines case-law, both recent and highly developed, which is useful for the lessons that stem from it.

CHONEZ, NICOLE
Permuted title or key-phrase indexes and the limiting of documentalist work needs. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.161–6. Describes the subject indexes to the computer-prepared bibliographical bulletins of the Central Documentation Service of the Commissariat â l'Energie Atomique, Saclay, France. Paper presented to 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August 1967.

DAHLBERG, INGETRAUT
Information department in the Center for Library Science and Methodology, Budapest. *Special Libraries,* vol.58, no.10, December 1967, p.710–12. Describes the information services of the center as well as its cataloguing method and printing processes.

DAMMERS, H. F.
Integrated information processing and the case for a national network. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.113–31. The various premises, which need consideration when developing a realistic and flexible information storage, retrieval and dissemination system, are discussed; their implication is illustrated with some examples from the development of the system at 'Shell' Research, Sittingbourne. Paper presented to 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August 1967.

DEUTSCHE Normen: Mikrofilmtechnik—Mikrofilm—Lochkarte für Film 35mm. [German standards: microfilm technique—aperture card for 35mm film.] *Reprographie,* vol.8, no.5, May 1968, p.132–3.

DITTRICH, W.
Einige Gedanken und Vorschläge zur Wissensordnung und Wissensvermittlung [Some thoughts and suggestions on the classification and conveyance of knowledge]. *Nachrichten für Dokumentation,* vol.19, no.3, April/May 1968, p.62–6.

DOUGHERTY, RICHARD M.
Manpower utilization in technical services. *Library Resources and Technical Services,* vol.12, no.1, Winter 1968, p.77–82. Examines three aspects of the subject. (1) Summarizes the results of a survey dealing, in part, with a librarian's efforts to improve manpower utilization, (2) looks at automation and how it may affect current personnel shortage, (3) suggests a short-term solution to the present problem.

FARRADANE, J.
The problems of input and their implications in mechanization. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.253–6. The implications of applying a fully structured indexing system to computer techniques are discussed. Paper presented to 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August 1967.

FRANK, OTTO
Mikrofilm—Aufnahmegeräte und Mikrofilm—Aufnahmemaschinen [Microfilm cameras and microfilm machines]. *Reprographie,* vol.8, no.5, May 1968, p.119–24. Machines for microfilming. Stepwise operated cameras. Flow cameras. Suppliers. Description of the models on the German market.

GERSHON, M. R.
Organisation of information. *O and M Bulletin,* vol.23, no.2, May 1968, p.99–109. Emphasizes the need for a centralized information service in an organization and suggests possible systems of information retrieval.

GOLTZ, SIEGFRIED
Erhebung über die Bibliotheks—einrichtungen in der Deutschen Demokratischen Republik [Survey of library establishments in the German Democratic Republic]. *Zentralblatt für Bibliothekswesen,* vol.82, no.5, May 1968, p.265–73. Early in 1967 all library establishments in the GDR were registered for the first time, under the auspices of the Ministry of Culture. The results of the survey are given; some problems which arose during the organization of the survey and the analysis of the questionnaires are dealt with.

GOODRUM, CHARLES A.
The reference factory revisited. *Library Journal,* vol.93, no.8, April 15th 1968, p.1577–80. A report on the streamlining of operations in the Library of Congress's legislative reference service.

GROGAN, PAUL J.
The State Technical Services Program at the national level. *Special Libraries,* vol.59, no.3, March 1968, p.186–91. The State Technical Services Act supports programmes of state, regional and national significance 'to place the findings of science usefully in the hands of American enterprise'. Extensive institutional involvement is required to accomplish this.

GUIGNARD, MARIE-ROBERTE
Les bibliothèques d'orientalisme a l'occasion de 27 congrès international des orientalistes, *Bulletin des Bibliothèques de France,* vol.13, no.2, February 1968, p.77–84. A report of the 27th international congress held at the University of Michigan for libraries working in the field of oriental studies.

GULL, C. D.
Logical flow charts and other new techniques for the administration of libraries and information centers. *Library Resources and Technical Services,* vol.12, no.1, Winter 1968, p.47–66. Looks at the application of new management knowledge and practice to libraries and suggests some directions in which research could be undertaken to benefit the management of information. Charts and diagrams.

HAKULINEN, ERKKI
Royal Caroline Medico-Chirurgical Institute. *Inspel,* vol.3, no.1, January 1968, p.24–5. New bibliographical activities in the library of the Royal Caroline Institute evolving from the use of MeSH.

HEINTZ, H. F.
The State Technical Services Program at the state level. *Special Libraries,* vol.59, no.3, March 1968, p.192–4. In developing Connecticut's first annual technical services program, it was necessary to probe beneath the surface of the state's economy to identify problem areas that could benefit from such programs.

HERBERT, PHILIP
Microfiche moves in. *Business Systems and Equipment,* November 1967, p.27 and 29. American experience of this sophisticated form of microfilm is now relevant to British business needs. An outline is given of the progress made on both sides of the Atlantic.

HILLMAN, DONALD J.
Negotiation of inquiries in an on-line retrieval system. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.219–38. Discusses a prototype retrieval system with

three major components for text processing, connectivity and decision operations. Paper presented to 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August 1967.

IVANOV, R. N.
A method for statistical analysis of technical information requests using computer equipment [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya. Seriya* 1, no.2, 1968, p.3–9. The article deals with a method of statistical analysis of technical information requests using punch-card and digital computers for processing initial data.

JAGER, H. D. M., *and others*
Information retrieval and future developments at the Mass Spectrometry Data Centre by H. D. M. Jager, D. C. Maxwell and R. G. Ridley. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.133–7. The activities of the Centre are described and details given of the methods used for the collection of data and information. Procedures for computer retrieval are discussed. Paper presented to 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August 1967.

JOLLEY, LEO
Relation codes: an ordering of ideas. *New Scientist,* vol.38, no.597, 16th May 1968, p.338–40. Concepts should preferably be ordered to reflect relationship. One scheme is suggested which can be derived by considering the possible types of relationship.

JONES, JOHN H.
No computer for our county. *Catalogue and Index,* no.10, April 1968, p.4–5, 7. The desirable features of a mechanised system for Hertfordshire County Library were considered by a working party. A detailed explanation is given, showing why systems currently available were considered unsuitable.

KHALADZHOV, R.
Unitermovata kartoteka—sredstvoza malka mekhanizatsiya na spravochniya aparat [Uniterm filing—a method for simple mechanisation]. *Bibliotekar* (Sofia), vol.15, no.3, March 1968, p.8–15.

KLÖTZER, F.
Erfahrungen bei der Verwendung von Kerblochkarten mit einer einfachen Sachgebietsverschlüsselung in der Dokumentation [Experience in the use of edge notched cards with simple subject coding in documentation]. *Nachrichten für Dokumentation,* vol.19, no.3, April/May 1968, p.89–95. Suggests that the simple consecutive numbering of keywords or keyword combinations no longer needs the restriction of a classification scheme.

KOSACHKOV, L. S. *and* KHURSIN, L. A.
The basic probability distribution in information flow systems [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya. Seriya* 2, no.2, 1968, p.3–12. The link between the basic probability distribution and some problems studied in the modern mathematical theory of information is considered.

LANCASTER, F. W.
Interaction between requesters and a large mechanized retrieval system. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.239–52. Discusses some of the problems of the user-system interface and suggests methods whereby these problems may be alleviated. Paper presented to 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August 1967.

LEIMKUHLER, FERDINAND F.
A literature search and file organization model. *American Documentation,* vol.19, no.2, April 1968, p.131–6. A model for assessing the relative efficiency of partial ordering is developed and used to determine optimal zone sizes under an assumed distribution pattern.

LASSLO, ANDREW
The librarian and the scientist. *Bulletin of the Medical Library Association,* vol.56, no.2, April 1968, p.141–4. Science librarians should serve as members of teams pursuing scientific research. The significance of the concept is interpreted in terms of trends characteristic of contemporary exploratory work.

LESK, MICHAEL E.
Performance of automatic information systems. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.201–18. The results of retrieval tests on three document collections are analysed to determine which methods offer the most efficient search and analysis procedures for use in automatic information centres. The SMART system is discussed. Paper presented to 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August, 1967.

LEVESQUE, ROBERT
The State Technical Services Program—an interface with industry. *Special Libraries,* vol.59, no.3, March 1968, p.195–200. State Technical Services activities as accomplished by the Technical Resources Center at Syracuse University, sponsored by the New York State Dept. of Commerce are described.

LIBRARIES and librarianship in the Soviet Union. *Library World,* vol.69, no.815, May 1968. A special issue dealing with many aspects of librarianship in the USSR.

LINE, MAURICE B.
Social scientists' information. *Social Science Research Council Newsletter,* no.3, May 1968, p.2–5. The problems of storing and using the rapidly increasing amount of information relevant to any aspect of social science research.

LONDON, GERTRUDE
The publication inflation. *American Documentation,* vol.19, no.2, April 1968, p.137–41. Suggests that the best way to cope with this explosion is to reduce the quantity and improve the quality of the printed records by filtering the material before it is stored for retrieval.

MAKHOTENKO, JU. A.
Some questions on improving the structure of the technical information unit in a big industrial plant [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya, Seriya* 1, no.2, 1968, p.10–13.

MAUPERON, ANDRÉ
What is being done about scientific information. *Metals and Materials,* March 1968, p.91–4. Suggests possible steps that might be taken towards solving some of the difficulties created by the rising output of scientific literature.

MEISTER, HANS-JOACHIM
Die Verwendung von Kunststoff—Versandtaschen im Leihverkehr [The use of plastics dispatch bags in interlibrary lending]. *Zentralblatt für Bibliothekswesen,* vol.82, no.5, May 1968, p.282–4. Report on the results of a test made by the Berlin University Library in co-operation with the Methodical Centre.

MERRY, SUSAN A.
The Ontario new universities library project —a centralised processing experiment completed. *College and Research Libraries,* vol.29, no.2, March 1968, p.104–8. The prime functions of the Project were the selection, acquisition and cataloguing of 34,600 titles in 44,510 volumes for each of five new academic libraries in Ontario. The paper charts acquisition figures, describes cataloguing practice and concludes with a comment on the computer produced catalogue.

MICROFILM in commerce and industry; recent developments from CAPS Equipment Limited. *Data Processing,* vol.10, no.3, May-June 1968, p.160–1. Describes a new low-cost microfilm reader that can be used with equal facility in both commercial and industrial applications. MIDAS (Micro-imaged-data addition system) is also described.

NEELAMEGHAN, A.
Books and articles: guiding principles for presentation of text. (Book science series. 1.) *Library Science with a slant to Documentation,* vol.5, no.1, March 1968, p.69–97. Discusses the need for, and helpfulness of, guiding principles for presentation of text—arrangement of ideas, structuring of text. Indicates the parallel between classification of subjects by the librarian and the analysis and synthesis of subjects by an author.

NITECKI, JOSEPH Z.
Reflection on the nature and limits of library science. *Journal of Library History,* vol.3, no.2, April 1968, p.103–19. Suggests that if the term "library science" denotes a unique discipline then it might be possible to formulate some comprehensive theories which would combine various aspects of librarianship.

NOVIKOV, A. P., *and* DEMCHENKO, A. S.
Co-ordination of effort between branch and regional scientific and technical information agencies [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya. Seriya* 1, no.2, 1968, p.19–21.

NOVIKOVA, T. YA.
Channelling information flows in the field of geology [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya. Seriya* 1, no.2, 1968, p.27–9. Describes the pattern of the main flow of secondary information concerned with unpublished materials on geology.

O'CONNOR, JOHN
Some questions concerning "information need". *American Documentation,* vol.19, no.2, June 1968, p.200–3. The obscurities involved in defining "information need" are indicated by critical questions, which those who write about it are invited to answer.

ORNE, JERROLD
The place of standards in the new technology of information science. *Special Libraries,* vol.58, no.10, December 1967, p.703–6. Describes in plain language the system by which American standards are formulated, reviewed, and approved, with special reference to information science.

OWEN, VICTOR W.
Mechanization of library procedures in the medium-sized medical library; vi. Selective Dissemination of Information. *Bulletin of the Medical Library Association,* vol.56, no.2, April 1968, p.123–31. As part of Washington University School of Medicine Library's programme for the use of computers an SDI system was tested. The project was to evaluate the system in relation to its users. Both the manual and computer operations of the system are described.

PASUKHINA, V. I.
On the necessity for more precise rules of patent description [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya. Seriya* 1, no.2, 1968, p.14–8. Some principal questions are considered concerning the cataloguing of invention specifications for author certificates and patents.

PERRY, PETER
Combined grouping for coordinate indexes. *American Documentation,* vol.19, no.2, April 1968, p.142–5. A method is suggested for the more economical storage of documents in co-ordinate indexes on the basis of inclusion relationships existing between sets of figures assigned to documents. The advantages, implications and applications of the method are discussed.

PHILLIPS, A. E.
The legal aspects of microfilming. *Reproduction,* vol.5, no.5, May 1968, p.26–7. In a talk given recently at the National Reprographic Centre for Documentation at Hatfield, a practising solicitor gave an insight into the legal standing of micro-imaged copies of documents.

POLZOVICS, IVAN
A Felsö Vezetöi és a Vezetöi Tájékoztatás föbb Kérdései [Information for top-management and management. Part I]. *Tudományos és Müszaki Tájékoztatás,* vol.15, no.3, March 1968, p.185–201.

POLZOVICS, IVAN
A Felsö Vezetöi és a Vezetöi Tájékoztatás föbb Kérdései [Information for top management and management. Part II]. *Tudományos és Müszaki Tájékoztatás,* vol.15, no.4–5, April 1968, p.320–38.

POTTER, ROBERT J.
The role of optics in information processing. *Applied Optics,* vol.7, no.1, January 1968, p.109–14. A review of optical applications to information processing problems.

PRABHAVI-VADHANA, CHUN
Tudományos és Müszaki Dokumentáció Thalföldön [Scientific and technical documentation in Thailand]. *Tudományos és Müszaki Tájékoztatás,* vol.15, no.3, March 1968, p.224–7.

PUTKONEN, ANNELI
Tutkimisen tarpeellisuudesta [The need for research]. *Kirjastolehti,* no.4, 1968, p.130–1, 134. Regrets lack of research in Finland and classifies the 640 studies made in the library school between 1946 and 1967.

QUICK indexes. *Nature,* vol.218, no.5142, May 18th, 1968, p.623–4. Surveys the time lag between when an article is published and when the abstract appears in B.T.I. and A.S.T.I.

RANGANATHAN, S. R.
Choice of scheme for classification. (Classification problems. 26). *Library Science with a Slant to Documentation,* vol.5, no.1, March 1968, p.1–69. After definition of essential items the following classification schemes are compared: Colon, Dewey, Library of Congress, Universal Decimal.

RAPID reading courses. *Which,* May 1968, p.156–160.

REVZIN, I. I.
Toward overcoming the crisis in computational linguistics [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya. Seriya* 2, no.2, 1968, p.39–42. A survey of the main papers presented at the International Conference for Automation of Linguistic Research, Grenoble, France, 23–25 August 1967.

RUBY, HOMER V.
Computerized circulation at Illinois State Library. *Illinois Libraries,* vol.50, no.2, February 1968, p.159–62. Describes the successful application of a computer to the problem of on-line circulation control.

SAGALOV, Z. V., *and* POLYAKOVA, E. A.
Determination of the most valuable periodicals in a special branch [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya. Seriya* 1, no.2, 1968, p.30–32.

SCHATZ, SHARON
Facsmile transmission in libraries; a state of the art survey. *Library Resources and Technical Services,* vol.12, no.1, Winter 1968, p5–15. A comprehensive analysis of experiments concerned with facsmile transmission. An extensive bibliography.

SCHRIFFRIN, ANDRE
Report from Cuba. *Library Journal,* vol.93, no.9, 1st May 1968, p.1865–7. An American publisher comments on a recent trip to Cuba, where he met Cuban librarians and visited libraries.

SIEK, ERICH
Seminarwoche für Leiter von Benutzungsabteilungen grosser Bibliotheken in Elgersburg/Thüringen [Seminar week for heads of reader service departments in large libraries in Elgersburg/Thuringia]. *Zentralblatt für Bibliothekswesen,* vol.82, no.5, May 1968, p.274–82. Joint discussion, between representatives from public and special libraries, on user problems and further professional education in librarianship, Nov. 13 to 18, 1967.

SLOANE, MARGARET N.
The validity of comparative technical library statistics. *Special Libraries,* vol.58, no.10, December 1967, p.692–6. Suggests that each library is unique and statistical comparisons should not be attempted.

SOMERFIELD, G. A.
Students' chemical information project. *Chemistry in Britain,* vol.4, no.2, February 1968, p.71–3. A project designed to provide final-year research students with experience of computer-based information services is being organized by OSTI in co-operation with The Chemical Society Research Unit in Information Dissemination and Retrieval.

SPARCK JONES, K., *and* NEEDHAM, R. M.
Automatic term classifications and retrieval. *Information Storage and Retrieval,* vol.4, no.2, June 1968, p.91–100. A brief description of research at the Cambridge Language Research Unit on the application of the theory of clumps and a discussion on some of the more interesting problems relevant to information retrieval research. Paper presented to the 1st International Conference on Mechanized Information Storage and Retrieval, Cranfield, 29–31 August, 1967.

STARKE, A. C., *and others*
GAF document storage and retrieval system, by A. C. Starke, F. R. Whaley, E. C. Carson and W. B. Thompson. *American Documentation,* vol.19, no.2, April 1968, p.173–80. The system is designed primarily for company reports but may include any documentary input.

STOLTENBERG, GERHARD
Dokumentation—Schlüssel zur Nutzung der Forschungsergebnisse [Documentation—the key to the utilization of research results]. *Nachrichten für Dokumentation,* vol.19, no.3, April/May 1968, p.57–8. Outlines a plan to cover the next few years for the establishment of an efficient national documentation and information system.

STRNAD, VOJTECH
Quelques aspects de la nouvelle loi tchécoslovaque [Some aspects of the new Czechoslovak Act]. *Revue Internationale du Droit D'Auteur,* vol.56, no.7, April 1968, p.7–39. Considers the changes and innovations introduced by the new Copyright Act.

SWANK, RAYNARD C.
Six items for export; international values in American librarianship. *Library Journal,* vol.88, no.4, 15th February 1968, p.711–7. This paper was given at the Cornell Library Conference and Dedication, October 1962.

SZEKELY, A.
National medical library and center for documentation, Budapest. *Inspel,* vol.3, no.1, January 1968, p.27–9. Medical librarianship in Hungary.

TELL, BJORN V.
Royal Institute of Technology and AB Atomenergi, Studsvik. *Inspel,* vol.3, no.1, January 1968, p.10–21. Describes the development of ABACUS—AB Atomenergi Computerized User-orientated Services; frame-work for computerized bibliographical work.

TUDOR, Alexandru
"Feedback"-ul intre cercetător si documentalist [Feedback between the research worker and the documentalist]. *Probleme de documentare si informare,* vol.2, no.3, March 1968, p.151–5.

UHLMANN, WOLFRAM
A thesaurus "nuclear science and technology"; principles of design. *Teknisk-Vetenskaplig Forskning,* vol.38, no.2, 1967, p.46–52.

UNIVERSITY of Leicester library. *Architectural Design,* vol.38, no.3, March 1968, p.137–40. Xerox.

VALOV, YU. I., *and* SOKOLOV, A. V.
Experience with development and operation of descriptor IRS's at a research institute [in Russian]. *Nauchno-Tekhnicheskaya Informatsiya. Seriya* 1, no.2, 1968, p.22–6.

WAY, WILLIAM
Subject heading authority list, computer prepared. *American Documentation,* vol.19, no.2, June 1968, p.188–99. A subject heading authority list containing main entries, scope notes, cross-references and subdivisions is compiled, printed and updated by computer.

WEIMERKIRCH, PHILIP J.
The use of title-page photography in cataloguing. *Library Resources and Technical Services,* vol.12, no.1, Winter 1968, p.37–46. Suggests that although this is an old idea it is now beginning to come into its own. In the U.S.A. it has been used for temporary cataloguing, whereas in Europe there have been recent examples of its use for full, permanent cataloguing.

YANEZ, A.
Le service de documentation scientifique et technique de l'armement et la dissémination sélective de l'information. *Doc-Air-Espace,* no.105, July 1967, p.3–4.

YENISH, JOSEPH
The Association of Jewish Libraries. *Special Libraries,* vol.58, no.10, December 1967, p.707–9. Gives an indication of history, purpose and scope of the Association.

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BUILDING RESEARCH STATION, Ministry of Public Building and Works, Garston, Watford, Herts. LIBRARIAN (graded E.O.) to take charge of acquisitions, cataloguing, classification and reader services in a large special library, and to co-operate with an associated information section under the overall supervision of the Head of Library. Experience of modern documentary techniques is essential. QUALIFICATIONS: Science degree, HNC, or equivalent. SALARY (minimum age 26): £1,365–£1,734. Prospect of permanent pensionable appointment. APPLICATION FORMS from the Director at the above address quoting RES/EO/3/E. Closing date 2nd August 1968.

COLLEGE OF LIBRARIANSHIP, WALES. Principal: F. N. Hogg, DPA, FLA, Department of Information Retrieval Studies. There are vacancies for LECTURERS/SENIOR LECTURERS within the Department. Successful candidates may concentrate on classification and cataloguing or the newer techniques of information retrieval. Within the Department an OSTI-supported project is under way to continue certain aspects of the Cranfield work, and staff will have the opportunity of collaborating on this. In addition to the conventional classification tools the Department has a punched card sorter and will have overall responsibility for a punched tape typewriter now on order. Senior Lecturer—£2,280–£2,595, Lecturer Grade II—£1,725–£2,280. Applications stating age, education, qualifications, experience, present post held, special interests, teaching experience, together with the names of three referees should be sent to the Registrar, College of Librarianship, Wales, Llanbadarn Fawr, Aberystwyth (telephone: Aberystwyth 3842). The closing date is Saturday 27th July 1968.

COMMONWEALTH AGRICULTURAL BUREAUX. Vacancy for SCIENTIFIC INFORMATION OFFICER, Commonwealth Bureaux of Plant Breeding and Genetics, Cambridge. Duties include preparation and editing of abstracts for the journal for *Plant Breeding Abstracts*, classification of biological literature and dealing with scientific enquiries. Applicants preferred with botanical or agricultural degree and some knowledge of or aptitude for foreign languages. Ability to write good English essential. Salary in scale £926–£2,431 with provision for superannuation. Starting salary according to age, qualifications and experience. Two extra increments after two years' satisfactory service for applicants aged 32 or under on date of appointment.

Requests for application forms and full particulars should be sent to the Director of the Bureau, School of Agriculture, Cambridge, by 5th August 1968.

LONDON BOROUGH OF ENFIELD: EDUCATION COMMITTEE, Enfield College of Technology, Queensway, Enfield, Middlesex (Proposed Polytechnic). Principal: G. S. Brosan, TD, PhD. Library. TUTOR/LIBRARIAN required as soon after 1st September as possible to take charge of the rapidly growing technology library. Applicants must be Chartered Librarians with relevant experience. A science graduate preferred but if this is not possible applicant must be a Fellow of the Library Association. Salary: Lecturer II—£1,795–£2,350. Application forms and further details obtainable from and returnable to the Academic Registrar within 14 days.

LIBRARIANS, GRADE III, Government Departments. Applications are invited from men and women for posts in the following Government libraries: (a) Royal Air Force College, Cranwell, Lincs. Scientific or engineering background an advantage; (b) Foreign Office Printed Library, London SW1. Knowledge of languages desirable; (c) Ministry of Public Building and Works Headquarters Library, London SE1. Interest in the range of subjects covered by the work of the Ministry an advantage; (d) Royal Aircraft Establishment, Farnborough, Hants; (e) Ministry of Technology Headquarters Library, London, WC2. Experience in scientific and technological literature an advantage. Qualifications: Candidates must (a) have passed one of the following professional examinations of the Library Association, viz. the Registration Examination (1963 or earlier), the Part II (Final) examination (1964 or subsequently), or the post-graduate professional examination; or (b) have otherwise attained Associateship of the Library Association; or (c) hold an approved university degree, or diploma, in librarianship. At least five years' professional experience and the ability to manage staff essential. Salary (National): £1,574—£1,874. Salary increased for officers serving in London. Non-contributory pension. Promotion prospects. Evening and week-end duty not usually required. Write to Civil Service Commission, Savile Row, London, W1X 2AA, for application form quoting 6948/68. Closing date 13th August 1968.

BEECHAM RESEARCH LABORATORIES

ASSISTANT FOR THE INFORMATION UNIT

This is a new appointment as a result of the expansion of our research facilities at the Vitamins Research Station, Walton Oaks, Tadworth, in Surrey.

The successful applicant will carry out literature searches on chemical and biological subjects and will assist with the use of mechanised information retrieval and the dissemination of this information within the research establishment.

Candidates should possess a degree, with chemistry and biology as main subjects. An appreciation of the techniques of information retrieval is necessary, a knowledge of German would be an advantage and some training in information science would be a help.

Vitamins Research Station is part of Beecham Research Laboratories and is situated in a pleasant area of Surrey. A generous starting salary will be offered and reviewed regularly, whilst there are excellent fringe benefits, including a profit-sharing scheme worth an additional 10–11 per cent of salary, and a non-contributory pension scheme with life assurance coverage.

Applications should be made to: **The Head of Personnel Department, Beecham Research Laboratories, Brockham Park, Betchworth, Surrey.**

ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 August 1968 Number 8

ASLIB CALENDAR 1968

September

MON.9 – WED.11	Course: Mechanization without computers.
TUE.17 – FRI.20	Course: Work in hospital medical libraries.
SUN.22 – WED.25	42nd Aslib Annual Conference at Canterbury.

October

TUE.1.	Midlands Branch Meeting: Economics of microfilming.
TUE.1 – FRI.4.	Course: Introduction to mechanization.
WED.9.	Chemical Group: symposium on toxicity.
THU.10.	One-day conference: Engineering Information Services.
FRI..11	Technical Translation Group meeting: Discussion on the evaluation of foreign matter, technique, etc.
MON.14 – FRI.25.	Senior Introductory Course.
WED.23.	Evening meeting: programmed learning.
MON.28 – WED.30.	Course: Dissemination of information.
WED.30.	Engineering Group Meeting. Engineering data sheets, by Dr A. J. Barrett.

November

FRI.1.	Course: Foreign language dictionaries.
MON.4 – FRI.8.	Course: Systems analysis.
TUE.12.	Chemical Group Conference.
THU.14.	Economics Group visit to *Financial Times*.
TUE.19 – FRI.22.	Course: Mechanization of housekeeping routines.
WED.20.	Institute of Information Scientists/Aslib joint meeting.
THU.21.	Engineering Group Meeting: Microfiching of periodicals.
TUE.26 – FRI.29.	Course: Introduction to business records.

December

WED.11.	Scottish Branch party.
MON.16 – WED.18.	Course: Literature of food and agriculture.
WED.18.	Aslib Christmas Party.

Aslib Computer Applications Group

For the past two years a number of interested librarians and others have been forming small working parties to investigate the application of computers to library procedures. The working parties, which have hitherto mainly been based on individual computer manufacturers, have now decided that the time is ripe to attempt to co-ordinate their separate efforts and have requested Aslib to form a Computer Applications Group. Lengthy discussions have been held among all concerned and the Group is now in process of formation.

The basic objects of the Group will be 'to promote the mechanization of library and information techniques by establishing criteria for systems and determining areas of common ground; by assessing existing or evolving systems and investigating the reasons for differences where these exist with a view to the development of common systems where this is practicable; and by communicating its findings, by publication, meetings, courses and conferences, and spreading appreciation and knowledge of the subject'. To further these ends it has been decided that full membership should be limited to those who are prepared to make an *active* contribution to one of its Working Parties on the various technical aspects of the main problem, and to members of the existing Aslib Mechanization Study Group, which will retain its identity as an Information Services Study Group within the new Group.

Initially, it is suggested that five Working Parties be established, each with not more than ten members, to consider the following topics:

(*a*) Acquisitions and cataloguing information
(*b*) Periodical records
(*c*) Circulation
(*d*) Information retrieval
(*e*) Record structure and file manipulation.

It is realized that this list is not exhaustive and that its headings may have to be added to, changed, or subdivided; it is accordingly suggested that intending members (see below) should specify which of the above topics they are particularly interested in, or should suggest alternatives. Should sufficient interest be shown in any topic, a Working Party will be formed.

Existing bodies such as Libraries and Computers, which is based on the North-East, and computer manufacturers' Working Parties, are invited to establish links with the Group on an associate basis as Study Groups; the committee may also from time to time itself propose the formation of Study Groups to discuss matters which do not fall within, or which cut across, the boundaries between its individual Working Parties.

One of the important functions of the Group will be to provide a framework for the exchange of information; to this end it is hoped that Aslib will assume responsibility for the quarterly journal *Program*, which will continue under the editorship of its founder, Mr R. T. Kimber, and will contain news of the Group's activities as well as other contributions.

A Group Committee has been elected, and now invites those interested to propose themselves for membership of the Working Parties. *Applicants must be actively engaged in an experimental or operational system of library mechanization, or* *alternatively, be able to demonstrate extensive and sophisticated knowledge of the applications of computers to libraries or information work.* They must also be prepared to work on specific projects.

Proposals should reach the Group's Secretary (Dr. M.F. Lynch, Postgraduate School of Librarianship and Information Science, The University, Sheffield S10 2TN) preferably not later than 16th September 1968, in order that an early start in organizing activities can be made.

Committee: A. G. Mackenzie, *Chairman,* (University of Lancaster Library); F. H. Ayres (AWRE, Aldermaston); P. Brown (Bodleian Library, Oxford); C. F. Cayless, *Treasurer* (University of Aston, Birmingham); H. Coblans (Aslib); R. E. Coward (BNB, London); H. F. Dammers (Shell Research Limited, Sittingbourne, Kent); B. J. Enright (City University, London); R. T. Kimber (Queen's University of Belfast) (Ex-officio, as editor of *Program*); M. F. Lynch, *Secretary* (University of Sheffield).

Transport Group

Since its beginning in 1964 as the independent Transport Information Group, and its affiliation to Aslib in 1966, this Group has had the aims of promoting greater co-operation among librarians and organizations connected with transport—its economic, operational and engineering aspects, and of providing means of exchange of ideas, information and material.

These aims have been served by publications: a newsletter (including, for example, accounts of members' libraries and of meetings, lists of material for disposal, of theses and other literature in transport), a directory of transport libraries, and a list of abstracting services; by liaison with other bodies, e.g. BSI in classification research; by forming a deposit collection of members' publications; and by educational and social meetings and visits. Two residential conferences have been held, and a third is being planned for 1969 in conjunction with the Engineering Group.

Other current plans include publication of conference papers and bibliographies, and direct involvement of members in practical projects to improve information services.

Membership of the Group is open to any corporate or individual member of Aslib, and anyone interested in the Group's activities should get in touch with the Secretary, Mr K. C. Walker, at the Lyon Playfair Library, Imperial College of Science and Technology, 180 Queens Gate, London SW7.

Technical Journals for Industry

Two further national lists in this series have now appeared. These are the lists for:

Australia:	Published by the Commonwealth Scientific and Industrial Research Organization, Melbourne.
Netherlands:	Published by the Nederlands Instituut voor Informatie, Documentatie en Registratuur, The Hague.

Chemical Information

The Northern Branch of the Institute of Information Scientists is to hold a one-day symposium on 'Coping with chemical information' in conjunction with the Manchester Area Sections of the Royal Institute of Chemistry, the Chemical Society and the Society for the Chemical Industry.

Speakers will include Miss A. R. Haygarth Jackson, Mr F. Newby, Mr R. D. Mannix, Mr E. Hyde and Dr G. A. Somerfield. There will also be a display of some modern equipment and facilities for retrieval of chemical information.

The symposium will take place in the Renold Building, University of Manchester Institute of Science and Technology, on Wednesday 9th October.

Further information may be obtained from Mr D. F. Styles, 55 Penrhyn Avenue, Alkrington, Middleton, Manchester.

Computer Handling of Chemical Structural Information

The Postgraduate School of Librarianship and Information Science of the University of Sheffield, which is actively engaged in research in the field of computer handling of chemical structural information, is presenting an intensive course on this subject from Tuesday 3rd to Thursday 5th September this year.

The course will deal with the general requirements for computer-based chemical structure information systems, and with the various methods for representing chemical structures for storage and search—fragmentation codes, chemical notations and codes, and topological representations. Options for input, output and file organization, and economic factors influencing the implementation of such systems and the use of future services will be described.

The course is intended for scientists, information staff and technical librarians, and presupposes no prior familiarity with computing techniques.

Attendance will be limited to twenty-five. The cost, inclusive of tuition and accommodation in Stephenson Hall, University of Sheffield, will be £15. The course will open with a dinner on Tuesday 3rd September and end at 4 p.m. on Thursday 5th September.

Information for the Construction Industry

The School of Librarianship and Information Work at College of Commerce, Liverpool, is proposing to hold a two-day course on the above theme on Thursday 19th and Friday 20th September 1968.

The aim of the course is to bring together a team of speakers who will describe the information services available to the industry from various organizations and discuss possibilities of future development and co-ordination of such services. A number of organizations concerned with information for the construction industry have agreed to send speakers.

It is hoped that this course will prove of interest to all concerned with information for the industry and particularly to organizations contemplating the setting up of an information service.

Further details can be obtained from Mr F. Gibbons, Lecturer in Librarianship, College of Commerce, Tithebarn Street, Liverpool 2.

REVIEWS

LIBRARY OF CONGRESS. Aerospace Technology Division. Reference Department. Glossary of Russian abbreviations and acronyms. Washington, Superintendent of Documents, 1967. x, 806 p. $5.95.

This new glossary is based on abbreviations in use by Russians in this century and on acronyms used in Soviet Russian publications since World War II. There are 23,600 entries which have been obtained from a large cross-section of Russian books and periodicals: the fifty basic reference sources are listed.

The glossary is arranged in Cyrillic alphabet order. The full Russian text of the abbreviation is given together with the English translation and occasionally a brief explanatory note. Dates are indicated for institutions of particular interest that are no longer in existence.

Although the publication is a general listing of abbreviations it includes a large number of terms from the aerospace field, as it was compiled by that Division of the Library of Congress. For any library using Russian literature this is an invaluable, comprehensive and inexpensive glossary.

BODLEIAN LIBRARY. Union list of serials in the Science Area, Oxford, 1968. 425 p.

Stage 1 of the *Union list of serials in the Science Area,* Oxford, has now been received at Aslib. Two further stages are planned and each will include and amplify its predecessor.

Stage 1 lists approximately 10,000 entries which are comprised of journals, periodical reports of institutes and societies and also numbered monographs. The holdings of forty-eight Oxford Libraries, mainly in scientific departments, are recorded together with the current serials on the open shelves in the Radcliffe Science Library and all new serials received at the RSL between January and September 1967. Any entries in RSL's existing catalogue which have been revised during this period have also been included.

An alphabetical list of the contributing libraries is included giving details of borrowing facilities for each library.

This listing will be of value particularly to those in and around Oxford, and when the next two stages have been completed the work should prove valuable both in identifying and locating scientific serials.

INDIAN NATIONAL SCIENTIFIC DOCUMENTATION CENTRE. Directory of Indian Scientific periodicals, 1968. 2nd edition. Delhi, INSDOC, 1968. 199 p. £1.

996 current periodicals are recorded in the revised second edition of this directory, compared with 725 listed in the 1964 edition. Full publication details are provided for each journal, and some indication of the nature of the contents is given. An appendix lists those periodicals which ceased between 1960 and 1966.

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COMMENTS ON THE TERMINOLOGY OF THE ANALYSIS OF LIBRARY SYSTEMS AND THE FUNCTION OF FORMS THEREIN

P. A. THOMAS *and* H. EAST
Aslib Research Department

A GREAT deal of effort on the part of the members of Aslib Research Department during the past two years has gone into systems studies of various types of libraries. Because the work has involved a variety of techniques, for example O & M, market survey and analysis prior to mechanization, there have arisen, from time to time, difficulties in communication within the department with regard to the description of library/information systems. In particular, the meaning and use of words in 'orthodox' management terminology (if there is such a thing) are not always particularly relevant in the analysis of library systems, although the techniques themselves may be very useful. Lacking any standardized terminology, a group of co-workers can at least attempt to isolate concepts and agree, amongst themselves, what words they are going to use to denote them.

These notes represent an attempt to define the *sub-systems* of a typical library, the *procedures* that are followed by the staff in working the sub-systems, and the *functions* of forms within these procedures. The need to define these terms has arisen specifically in a project which involves a study of the use of bibliographic records in libraries. This project aims to discover, by investigation of the workings of a number of libraries (with different objectives)

(*a*) What kinds of bibliographic records are currently made
(*b*) What descriptive elements go into each kind of record
(*c*) What purposes are served by these bibliographic records, and therefore
(*d*) What purposes are served by each element in the record.

In each library we have followed the use of bibliographic records by tracing and collecting examples of their manifestation as 'forms' recording some description of an individual bibliographical item. (For this purpose, 'forms' have been broadly defined as documents having some function in a library procedure (e.g. order form, book card, the writing on the flyleaf of a book showing author, title, details for use in photocharging systems).) So far, we have concentrated mainly on the 'housekeeping' activities of the libraries in question.

We have restricted the use of the term 'library system' to the whole complex of library operations*—this is in line with one of several definitions of 'system' in Webster's dictionary: 'A complex unity formed of many often diverse parts subject to a common plan or serving a common purpose'.

A 'library system' in fact consists of a hierarchy of systems and we have decided to use the term 'sub-system' to denote operations within the larger complex. The IOM has suggested[1] that an office can be defined as having the five following 'functions':

Receiving
Recording
Arranging } Information
Giving
Safeguarding Assets.

The sub-systems that we have defined for library housekeeping operations, namely

Acquisition
Processing
Use
Maintenance

clearly have functions related to those of an office, as defined by the IOM. There is, however, one important function of a library that is omitted from the IOM list, that of obtaining information. With this addition, we can concede the general parallel that

The library sub-systems	Acquisition Processing Use Maintenance	have the function of	obtaining receiving recording arranging giving	information
			safeguarding assets	

At the next level of systems organization we have defined a group of nineteen *procedures* which make up the various sub-systems. The procedures have been given the following names:

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* Throughout this paper the word 'operation' has been used in a loose and undefined manner. Where it has been used, the meaning can be taken to imply an 'event' or series of events—the equivalent of a node in a PERT network diagram. It implies the occurrence of some (undefined) change brought about by the action of library personnel.

In fact, 'operation' is one of the terms recommended by the Institute of Office Management (IOM) and used in the definition of job descriptions. We are not here concerned with the evaluation of tasks and jobs, which are related to the work loads of individuals, or groups of individuals.

Sub-system	*Procedure*
Acquisition	select order receive
Processing	accession catalogue classify label list shelve
Use	locate lend reserve recall borrow return photocopy
Maintenance	bind replace discard

These procedures are characteristic of libraries and presumably of no other type of organization. One would consequently not expect to find parallel classifications with which comparisons could be made. However, we are particularly interested in the functions of forms in libraries and we should perhaps expect some definitions from management science to be helpful. Knox[2] lists eighteen 'essential functions' of forms in offices. He notes that the definition of the word 'function' is a problem but does not expand upon it. We have not found the list particularly useful in defining the function of forms in the library procedures listed above. This is mainly because what Knox describes as a 'function' is more closely related to those actions, such as ordering and receiving, which we have classified at a procedural level. Hence the discrepancy between the numbers of 'functions' in his list and in the one given below. We do not wish to imply that the functions of forms in libraries are limited compared with standard office procedures. The list we give here has been found to cover all cases of form usage (related specifically to bibliographic description) in the library procedures defined previously.

Forms are used

to initiate to authorize to activate to record to report to cancel	a procedure

An attempted definition of these functions is given below.

initiate	—that which makes it apparent that a procedure should be started. It can be a form from a previous procedure; it can be a form from outside the library e.g. publisher's catalogue, *BNB*, or a Regional loans' form; it can be the book itself, or a telephone call from a library user.
authorize	—in some cases, the decision to carry out a certain procedure must be approved before any further action is taken; this is usually done by signing a form.
activate	—when a procedure is known to be necessary, and in some cases approved, it is usually implemented by means of a form. We have also used it to include the idea of re-activation or follow up of a procedure, e.g. letters sent to suppliers on non-arrival as well as the original order, activate the ordering procedure.
record	—the function fulfilled by a form that states or records what action has been taken.
report	—with connotations of 'notify' someone, library staff or user, that an action has been taken.
cancel	—to stop a procedure, in particular the aspect of revoking, or undoing an action e.g. 'un-issuing' a book is the cancellation of the lending procedure.

It must be emphasized that a particular form may, and often does, have several functions and be used in a number of different procedures. For example, a given form can initiate and authorise selection, initiate and, in some cases, activate ordering, record receipt and finally be used as a permanent record in the accessions procedure. (In this particular example, the multi-function form not only is used in several procedures, but also passes from one sub-system to another.) In the analysis of approximately 480 forms in use in the twelve libraries we have been studying, every identified function has been amenable to classification under one of the six headings given above.

The definition, at a fairly fundamental level, of what are the functions of a particular form is necessary if one hopes to isolate an optimum set of bibliographic elements for library systems. It is not enough to know what, traditionally, are the elements used in following a particular procedure. We must examine what part is played by an element in order first, to justify its inclusion and second, to determine the manner in which it should be recorded. To do this it is necessary to look at the form at the lowest identifiable functional level within each procedure, because the use of some forms can be common to a number of procedures and it is necessary to know what part they are playing in each.

Much interest and effort in this country and in the United States is being devoted to the production of machine-readable bibliographic descriptions. The emphasis in the designing of these records seems to have centred on the style of the traditional catalogue entry. It is at least debatable that concentration on the cataloguing aspect of library activities—whose functions are probably the least clearly understood[3]—is not likely to be the area in which most libraries with the exception of large archival organizations, will receive the greatest returns. It may not be correct to assume that the elements of bibliographic description used in other library procedures are a subset of those traditionally employed by the cataloguing operation. Further, the optimum organization of records for non-cataloguing procedures may differ from catalogue-based requirements. A much clearer understanding of what records are necessary in the organization of library systems, their value, and what part they play is a pre-requisite of the beneficial application of new techniques.

The design and control of forms for use in library procedures is not central to our present project, but we think such information on the functioning of forms is necessary to any work in this area.

The six functions we have identified are at a more basic level than that usually referred to in the library context, where the function of a form is tied to the procedural level, e.g. 'order' forms, 'accession' registers. The need for only one of our six functions is presently acknowledged, the 'record' function. Indeed, perhaps significantly, forms in libraries are more often referred to as 'records'.

All libraries seem to have forms functioning in the identified manner within the same procedures, but the number and format vary because of the variance in usage. No two libraries will necessarily use any one form in the same combination of procedures. In some libraries the emphasis is on movement of the form from department to department and file to file, in others on the production and distribution of multiple copies of one form. There does not at present appear to be any reason why a particular form should be used in a particular way, or tied to a particular number of secondary (additional) functions or procedures.

However, it does seem that, as the level of function we have identified is common not only to the procedures listed but to their operation in libraries of different types, this information should be helpful not only in designing for new techniques, but also in reviewing present practice or in the setting up of new but conventionally based library systems.

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3 GROSE, M. W., *and* LINE, M. B. On the construction and care of white elephants; some fundamental questions concerning the catalogue. *Library Association Record*, vol. 70, no. 1, Jan. 1968, p. 2–5.

THESAURUS COMPILATION METHODS: A LITERATURE REVIEW

J. F. BLAGDEN

British Institute of Management

1. INTRODUCTION

THIS review has been sponsored by the Office for Scientific and Technical Information and the end product of the complete research will be a thesaurus of management terms. Parallel research in the business management area and also supported by OSTI[45] is being conducted by David Dews, Librarian of the Manchester Business School, and K. D. C. Vernon, Librarian of the London Graduate School of Business Studies. As Mr Vernon is at present engaged in the construction of a faceted classification scheme for management, this investigation has concentrated on the possibility of utilizing faceted techniques to construct such a thesaurus.

A study of existing information retrieval systems in the management field has already been made, so a decision to adopt some form of post-co-ordinate indexing was assumed. Thus a comparative study of other systems will not be attempted. A decision has also already been made that a controlled vocabulary, i.e. a thesaurus, was eventually going to be developed despite the latest Cranfield results[11] that appear to provide evidence of the superiority of natural language over controlled vocabularies. This was primarily because these results were restricted to tests on an aeronautical collection, and it may well be that the natural language of this discipline is in itself a fairly controlled one, which is certainly not the case with the rather 'soft' language of management. This is borne out to some extent by Halkin[23], who quotes relevance figures for co-ordinate indexing applied to organic chemistry (55 per cent), engineering (35 per cent), and social science (20 per cent).

Machine methods of term generation as described by Ovchinnikov[46–47], Mastermann[40] and Luhn[38] will not be considered, as there is no equipment available to prepare thesauri on the lines these authors suggest.

2. SOURCES

The literature survey itself was based on the bibliography prepared by Gaster[19]; *Library Literature* (1948 to date); *American Documentation*; *Documentation Abstracts* (1948 to date); and *Library Science Abstracts* (1956 to date). A great many more references were read than are quoted, because many were found to be repetitive. However, inclusion is not really a seal of merit, as superior references that appeared when the survey was near completion may have been omitted simply on grounds of expediency, or because they added substantially nothing to the references already culled. In any case, with a restricted amount of time available, only a relatively short period could be allocated to this aspect of the research. This survey, then, is selective with regard to both references covered and topics considered (e.g. semantics and linguistics have largely been ignored).

3. THE WORD 'THESAURUS'

Vickery[65] and Model[42] trace the historical origin of the word and its current documentation connotation. Model actually maintains that Brunetto Latini was the first to ever use the word, as far back as the thirteenth century, but not, of course, in a documentation sense. Scheele[54], however, hits the nail right on the head when he states that in the word *thesaurus* we have a drastic example of how a more and more specialized meaning has been ascribed step by step to an expression which above all expresses something very general. Scheele goes on to comment that, although ambiguity may arise because of the use of this word, it has now established itself within the framework of documentation and we have therefore got to live with it. Using the word in the information-retrieval sense, Wall[69] maintains that a thesaurus must list terms, exhibit relationships and define vocabulary. Writers such as Shaw[56] use the thesaurus as a searching aid only, and not as a means of controlling indexing. However, as far as this investigation is concerned both functions of the thesaurus will be considered. It is interesting here to note that London[37] has used a thesaurus as an aid in classifying by the Universal Decimal Classification. This is a contrast to the conventional specific subject index that one encounters with the UDC schedules, but, of course, this approach is not relevant to this study, as UDC has already been found lacking for the purposes of retrieving management literature.

4. CONSTRUCTION METHODS

These can rather arbitrarily be divided into the methods by which one assembles the terms and the subsequent rules that are formulated to produce a rational array of these terms.

4a Assembly Methods

(i) Users and subject specialists

Almost every method at some stage or other attempts to enlist the aid of users or subject specialists. However, Pickford[49] allowed his users almost exclusively to generate the thesaurus vocabulary from selected articles sent, providing they followed certain grammatical rules. I believe the author was fortunate in working in the restricted field of biomedical engineering. Greer[22] also suggests that users should select vocabulary and that this should be based on the significant words of actual questions that they pose to the documentation centre. He maintains also that far too much emphasis has been placed on the contribution that the systems designer or statistician can make to this vocabulary problem. However, one of the disadvantages of this laudable approach is that one is inevitably indexing a great deal of literature which may never by required or, what is more important, has not been requested on the basis of the questions *so far* fired at the centre. How then can an indexer record this category of documentation if the indexing terms are exclusively tied to questions? The problem is tackled somewhat more fully by Reisner[50], who maintains that because of the 'semantic diversity' of users' language some attempt should be made to study these interpersonal differences of vocabulary. She suggests using the word-association methods of psychologists, who derive a norm from a commonality of responses. Reisner maintains that, although traditional thesauri will refer the user who wants information on A to B, there is no guarantee that he will search under either A or B. She therefore proposes to produce an initial vocabulary based on user profiles in a SDI system, and then modify this on the basis of the comments that they receive on the effectiveness of the system. A strong case is made for bringing users in, but really Reisner's approach differs only in its timing, as users consciously or unconsciously aid in debugging a system *after* a thesaurus is established.

The Engineers Joint Council[16] approach to vocabulary construction is the classical analytical one whereby hundreds of experts and glossaries are consulted to produce the initial list of terms. This list is then refined by an editorial staff and *then* finally utilized to index actual literature. Ullmann[61] points out that when this approach is adopted the resultant thesaurus can easily be purged of terms that have become obsolete through lack of use. One interesting variation on this method was suggested by Papier and Cortelyou[48], who used a word-association method to develop their vocabulary. They did this by providing experts with a list of terms and then requested these experts to provide the first technical term suggested by each word.

The dangers of using the subject specialist is that he may not be acquainted in depth with the literature or the use that will be made of this material once it is recorded. He will also tend to make distinctions in terminology which, although academically defensible, make indexing and searching unnecessarily difficult. Finally he may only be an expert in a subject which comprises a small part of the area being covered by the thesaurus, in which case he will almost certainly inflate the importance of his own speciality.

(*ii*) *Literature-based terms*

Jaster, Murray, and Taube[31] regard the empirical development of vocabulary direct from the literature as one of the main methods of thesaurus compilation. Holm and Rasmussen[28] adopted this method, the terms initially being entered into a vocabulary as a result of free indexing of technical documents. This approach was also adopted by Johnson[32], in that a sample of reports were indexed with no attempt being made to eliminate synonyms or introduce any structural elements into the vocabulary. In both these cases the terms were then edited with the help of subject specialists and refined by actual use.

(*iii*) *Use of existing word lists*

Jaster, Murray and Taube[31] again state that often word lists already published could possibly provide the basis for a thesaurus. However, examples are not quoted and one suspects that one of the main reasons for preparing a thesaurus is the inadequacy of existing word lists. Even where these do exist their rigid adoption would nullify the flexible advantages of a thesaurus tailor-made to the exact requirements of the users. Subject headings lists can still be useful, however, as a double check on vocabulary choice.

(*iv*) *Use of Classification*

Jaster, Murray and Taube[31] in 1962 maintained that vocabularies derived from classification schemes had rarely been used, and they argued that if they were utilized the retrieval effort would have to be greater than when using the original scheme. They also queried whether existing schemes were specific enough and pointed out that many individually unique documents with collections would have to be forced into broad classes. This criticism on the grounds of specificity is echoed by Dahlberg[15], who points out that *unlike* classification systems, a thesaurus comprises the maximum number of words within the scope of a given concept. Despite these comments a number of advocates for the employment of classification for this purpose have been discovered in the literature.

As early as 1958 Rosser[52] used facets in the subject index to the classification scheme of the US National Advisory Committee for Aeronautics to control a simple uniterm vocabulary. Hill[25] also produced a faceted classification, but this was not subsequently used as a basis for a thesaurus, although searching was done by a feature card sequence arranged primarily by the facets of the scheme. This, of course, was a convenient way of avoiding the permuting problems of indexes to faceted schemes. McClelland and Mapleson[39] also show how a crude classification can help to eliminate noise when searching.

Model[42] makes a plea for using the Universal Decimal Classification in the construction of a thesaurus. Verona[64] also points out that the Universal Decimal Classification can be used, but only rarely in its entirety because of inherent defects in the scheme. Nevertheless she argues that thesaurus compilation is an ardous task and that by using the Universal Decimal Classification a vocabulary can be much more quickly prepared even though language and shallow coverage provide additional problems. Despite these difficulties, the author suggests using the terms raw from the schedules, arranging the feature cards in classified order, arguing that all problems of syntax are thereby overcome. An additional advantage is that thesaurus updating can be handled centrally by the Fédération International de Documentation. In fact, in a recent issue of the *FID Bulletin*[17], mention is made of an experiment being carried out at the All-Union Research Institute of the USSR to investigate the possibility of using the UDC as a basis for a multi-aspect information retrieval system, using either a uniterm or feature method of recording.

Faceted classification was again, surprisingly, used for thesaurus construction as early as 1958 by Wadington[67]. He constructed such a classification, and then became worried because, with a document collection of 100,000, he estimated that he would need 800,000 cards for adequate indexing. Wadington therefore adopted a unit-concept, co-ordinate indexing system using his amplified version of the Colon Classification to ensure consistent indexing and, where desirable, the formulation of generic specific relationships. Synonyms can also be eliminated because, instead of the whole vocabulary having to be searched, the logical layout of the scheme can achieve this object much more rapidly. Meyer[41] also advocates the use of faceted techniques, as does Bauer[5], who maintains that the weakness of both enumerative classification and co-ordinate indexing can be overcome by using facet analysis to produce the vocabulary. He also stresses that one must be careful to distinguish between a facet and a category when working out the vocabulary, although he does not say why one should take such care.

Mulvihill and Brenner[44] go into a little more detail as to how this can be achieved in practice, citing a number of examples from a 'faceted' thesaurus devised for the American Petroleum Institute. They mainly emphasize the advantage of generic formulation, although the scheme does help with the automatic posting-up system that the American Petroleum Institute adopts for related terms, as well as for the straightforward genus-species relationship. Their scheme is also helpful in suggesting additional relationships between terms from different facets, mainly of the *see also* type. Finally, the authors maintain that once the thesaurus is complete the facet structure from which it was derived continues to be of value, functioning as a guide for the addition of new terms to the thesaurus.

Campbell[9] reiterates how effective faceted techniques are in detecting synonyms, and says that he was often surprised at the number of facets one term could generate. He actually tested the effectiveness of a faceted classification with a non-faceted scheme for synonym detection, and found that faceted techniques were 75 per cent successful, whilst the non-faceted scheme produced only some 62 per cent. These tests were based on an indexed collection of three thousand. It was interesting to note that in Campbell's faceted scheme there was a residual class which included mathematics marketing and costing terms. It is, of course, precisely this type of term for which we will be constructing a thesaurus and this could be indicative of how difficult it will be to apply faceted techniques to subjects that go largely in a miscellaneous section.

(*v*) (*a*) *Restrictions by compression—size of vocabulary*

There are several devices which one can use to deliberately restrict vocabulary, and a common approach is to assemble a list of terms by one of the methods already quoted and then compress these terms into broader concepts.

Fairthorne[18] does not like this practice of confounding terms, because their meaning is blunted. However, protagonists of this deliberate restriction such as Snel[58], Boyd[7] Harden[24], and Hutton and Rostron[30], maintain that it ensures that both indexing and searching are kept simple. They also argue that it allows for human intelligence to play a bigger part in the retrieval process, by allowing the sifting of the literature to be done when the documents are assembled by the *searcher* and not by the system. They also maintain that one generally only needs to employ a small number of feature cards at the searching stage to reduce the number of documents retrieved to acceptable searching levels. A magic figure of around five hundred terms has been quoted as the desirable number needed to achieve this object, although Kaiser[36] maintains that only 152 words were needed to formulate all essential questions for information retrieval in the field of atomic spectrochemistry. He quotes similar low figures for other related fields, although no figures are given for the size of the document collection.

Joyce and Needham[35] provide additional support for a restricted vocabulary, as the authors assume that the more terms one uses the more noise a system will generate. No tests, however, would appear to have been conducted at this stage on co-ordinate indexing systems using vocabularies of varying size.

There is, however, the problem of generics when this approach is adopted, as pointed out by Sharp[55]. He takes an example from Boyd's vocabulary of BIG END see HIGH + LAST to illustrate the problem. If one wishes to generically encode BIG ENDS as BEARINGS, one presumably will have to put references in one's thesaurus stating HIGH when used as BIG in BIG END punch up to BEARINGS and LAST punch up to BEARINGS when used as END in BIG END. One possible way round this difficulty is simply to have a reference in the thesaurus BIG END see HIGH + LAST + BEARINGS.

In the same discussions Cleverdon[13] admirably sums up the whole question of vocabulary size when he comments 'that much of the disagreement has been due to the fact that speakers were arguing from different viewpoints. If it was found that a particular system operated satisfactorily for a certain organization, then obviously there was no need to find fault with it. However, it was unjustifiable to make claim as speakers had done that the same system would necessarily operate satisfactorily in all other situations. There were obvious differences where one organization was more interested in having a good recall ratio and was relatively unconcerned about relevance, whilst another organization was more interested in having a good relevance ratio. Certain indexing devices were available which could bring about either of these situations but it was unlikely that any of the operating systems discussed would satisfactorily meet both requirements.'

A corollary to Cleverdon's comments on recall and relevance is that if one designs a system with high recall and relatively low relevance built in, this is a situation one has to live with unless one is going in for expensive re-indexing. If, however, one designs a high-relevance system, i.e. more index entry terms, then one can possibly achieve a high recall as well by the simple expedient of additional searches. In a way, Wall[68] provides evidence to support this argument of broadening searches as a result of some tests he conducted on the American Institute of Chemical Engineers' Thesaurus. He first searched under three terms actually used in the query and produced an 8 per cent recall figure and a 100 per cent relevance figure. He then searched with a further sixteen terms from the thesaurus and stepped up the recall figure to 68 per cent whilst, of course, his relevance figure dropped to 49 per cent. One comment on these figures is that when the search strategy is altered you are really asking a different question of the system and therefore the irrelevant documents that are retrieved are not necessarily due to system defects.

(*v*) (*b*) *Restriction by digraphs and trigraphs*

Another restriction method is proposed by Jolley[33], who employs coding systems such as AB = Leeds, BC = Glasgow, AC = Liverpool, BD = Manchester, AD = London, and CD = Birmingham. Thus six cities are symbolized by four characters, but no economic justification for the use of these devices, i.e. storage space versus increased punching time, is given. Of course, by using three-letter codes (trigraphs) greater economies of cards can be achieved, although the noise potential of this method would theoretically appear to be high. This, of course, is only one coding method and there are others available. It also raises the question of how much the physical form of the index determines vocabulary size. For example, if edge-notched cards were employed there would be a limitation on the number of features or some coding method would have to be adopted. Even with Peek-a-boo systems, which theoretically can employ an unlimited number of features, the capacity of the storage equipment will also have some effect, if a less tangible one, on size of vocabulary. A study of the effect of equipment has not, however, been undertaken as part of this study, although Baker[4] did gather together the data on Peek-a-boo equipment currently available.

These deliberate policies of restriction have much in common with the technique of semantic factoring mentioned by Williams[70].

(*v*) (*c*) *Pre-co-ordination and the use of roles and links*

Throughout this report I have used the words *uniterm, unit concept, descriptor, keyword,* and *feature* as synonymous with those words that are going to be used both as index entry terms and for searching purposes. Some might quarrel with the inclusion of the word *uniterm,* because of the presupposition that this is a one-word term and therefore not quite synonymous with the other cited words. However, Howerton[29] maintains that a uniterm is not necessarily a single-word term. A pre-co-ordination complication of the other sort is presented by Aries[2], who uses a form of sentence structure to generate his terms.

This dilemma of how to define a term was spotlighted by the investigator[6] in a study of the amount of noise in a system that did not employ links or roles. The problem was to distinguish between documents that were retrieved because of bad vocabulary choice and those noisy items retrieved because links and roles were not used. .

Notwithstanding this difficulty, roles have been defined by Costello[14] 'as numbers (I prefer symbols) appended to terms to preserve in inverted co-ordinate indexes as indication or designation of context function or sense of use'. Vickery[66] has likewise defined links as a neutral symbol, a simple tag attached to a descriptor to indicate other descriptors with which it is interlocked. However, Artandi and Hines[3] argue that roles are indistinguishable from the sub-heading found in any conventional subject index. Hines[26] repeats this comment and goes on to say that one of the advantages of co-ordinate indexing is that the number of cards in a manual system are considerably less compared with other systems. If, however, one uses the Engineers Joint Council thesaurus, where roles and links are employed throughout, the number of cards required could theoretically be increased elevenfold (the Council maintains that in practice it is about fivefold), thereby nullifying the advantage already mentioned. Hines ends up by caustically pointing out that 'we seem to be constantly rediscovering the wheel'. Cleverdon[11] also gives examples of the use of roles, links and pre-co-ordinated terms taken from the schedules of the Universal Decimal Classification, thereby re-emphasizing the point that although we now have new labels the devices themselves are certainly not new.

Part of the confusion has arisen because in the two definitions quoted the definers both see roles and links in terms of neutral symbols, thereby presuming no increase in the indexing vocabulary. However, in an optical coincidence card system although roles could be applied in this neutral way by differently shaped holes, for example, there would not appear to be any method of applying links without increasing the number of cards. Once one accepts this increase, there really is no difference between these devices and the traditional sub-heading. This is confirmed by Jones[34], who uses links and roles by pre-co-ordinating some terms.

Nevertheless, despite the difficulties of adequately defining roles and links, there have been a number of studies evaluating their effectiveness. Taube[60] stresses that as they increase input costs they should not be used unless the number of postings under a single term indicate that to split the term into its various roles may be worth while. He goes on to argue against links by quoting the example of LEAD 100A, COATING 100A, COPPER 100B, PIPES 100B, using letters to avoid the noisy situation of retrieving information on the copper coating of lead pipes. The disadvantage as Taube sees it is that by using this device a query requesting literature on coating pipes will also not retrieve this item. On the other hand, Holm[28] indicates that, although input costs rise, precision at the searching stage is increased.

There have also been a number of actual tests performed on these devices and Sinnett[57] maintained that as roles doubled input costs and computer searching time and only increased precision by 2.7 per cent their use should be discontinued. Montague[43], however, argued that roles increase precision, but links had little effect and both impaired recall. Montague did add that links may have had little effect, because most of the patents indexed were concerned with only one process. Aitchison and Cleverdon[1] tested on an exhaustive scale the indexing system of the Western Reserve University which did employ both roles and links. It is difficult to summarize these results, especially as roles were used in only 27 per cent of the search programs. However, the overall impression is that these devices did improve precision at the expense of recall and increased input costs. Van Oot *et al.*[63] also tested their system and found, contrary to most previous reporters, that the introduction of roles and links was economically feasible and efficient. They, however, also pointed out that there is no universal answer to this noise problem and listed the following criteria that should be considered before these devices are introduced: (*a*) size of document collection, (*b*) number of questions, (*c*) the rate of obsolescence of indexed information, (*d*) subject field, (*e*) type of roles and links proposed, (*f*) depth of indexing, and (*g*) the number of free and pre-co-ordinated terms. This last criterion would suggest that these authors feel that there is a valid distinction to be made between pre-co-ordination and roles and links, which is really where the discussion started. I would suggest the additional points to be observed should be the crucial comments on recall and relevance quoted by Cleverdon[12] and the number of documents retrieved per search, because if this figure is low there is no need to introduce any further precision aids. This is partly borne out by a study conducted by the investigator[6] on a role-free and link-free system.

Assuming that there is a difference between pre-co-ordinated terms and roles and links, are there any guidelines for vocabulary compilers to suggest when and when not to pre-co-ordinate terms? Campbell[9] advocates the use of bound (pre-co-ordinated) terms when common use dictates, e.g. operations research, work study, etc. Graf[22] points out that one of the advantages of splitting terms is the reduction of the number of cards, providing, of course, that the splitting produces terms that can be used in other contexts. In the German language, this issue becomes somewhat obscure, because apparently on a great number of occasions one can combine two words to make a completely new word, so that it is difficult to tell whether conscious pre-co-ordination has taken place or not. Schanche[53] makes a similar comment on Scandinavian languages.

The *DOD Manual*[62] provides a number of practical working rules to give some idea as to when to pre-co-ordinate, and the significant ones are quoted below:

1 When the meaning of one of the terms would be changed as a result of the combination, i.e. LANDING LIGHTS cannot properly be represented by a combination of the terms LANDING and LIGHTS because to do so would result in an improper use of the term LANDING and would lessen its effectiveness in retrieval.
2 When each term of the combination falls into a generic class which differs from the specific pre-combined term.
3 When the pre-combined term represents a concept that is encountered so frequently in both indexing and searching that it is economical to have this term.
4 When reasonable doubt remains after examining the foregoing criteria if a specific term is established and later proves to be superfluous it can easily be reduced to a combination of terms. The reverse process is more costly and difficult.

4b Term Rationalization

Once the raw terms have been collected, the grammatical form of these terms has to be decided as well as the problems of synonyms, homonyms, and generics. Once again the *DOD Manual*[62] provides a practical guide and the rules quoted below have largely been culled from this source and an article by Speight[59].

(*i*) *Term selection*

In the *DOD Manual* no distinction is made between terms in the thesaurus and those that are actually employed in indexing and searching. However, the 'lead in' terms are not really relevant to this aspect of the study and the criteria for selection will apply to index and search terms.

The *Manual* suggests the following criteria: (*a*) relative frequency of appearance in published vocabularies, (*b*) frequency of use within the system, (*c*) relationships with terms already approved, and (*d*) scientific or technical precision and acceptability. The *Manual* also recommends avoiding the inclusion of terms whose meanings overlap considerably with terms already established in the thesaurus so that both indexers and searchers would have difficulty in distinguishing between them.

It is typical of the Engineers Joint Council approach that no mention is made of the frequency of use within the literature to be indexed, as essentially thesauri developed on EJC lines are produced before indexing actually takes place.

(ii) Noun and verb forms

Recommends the use of noun forms wherever possible and the gerund form is to be preferred to the verb form.

(iii) Singular and plural

States that the plural form ought to be used when the term answers the question 'how many'? e.g. GAGES, NOZZLES, etc., and singular when the term answers the question 'how much'? e.g. IRON, WOOD, etc. Common usage should be the overriding factor.

(iv) Polyterms

These should be listed in their natural word order, i.e. REFRACTORY MATERIALS not MATERIALS REFRACTORY. The problem of precombined terms and the use of roles and links has already been discussed in a different section of this report.

(v) Abbreviations

These should be avoided wherever possible.

(vi) Definitions

Scope notes to terms should be appended where the meaning is not clear; this is particularly true of homonyms (referred to sometimes as homographs), e.g. MERCURY (planet) and MERCURY (metal).

(vii) Synonyms

When two or more candidate terms are true synonyms, one term will be selected as the descriptor, the others entered as a cross-reference. Wall[68] maintains that there are very few true synonyms other than spelling variations. However, in the context of any given information retrieval system many terms are sufficiently close in meaning to be treated as synonyms.

(viii) Quasi synonyms

Speight[59] re-emphasizes what Wall[68] has already pointed out under Synonyms, but goes on to suggest that terms that represent viewpoints of the same property continuum may also be considered as quasi synonyms, e.g. SMOOTHNESS and ROUGHNESS. However, Papier and Cortelyou[48] query this practice on the basis of tests that they have conducted.

(ix) Generics

Both Holm and Rasmussen[27] and Gillum *et al.*[20] discuss the problem term that cuts across many generics. Holm and Rasmussen illustrate the point with the example OIL, which is a FUEL, a ROAD SURFACING MATERIAL, a VEHICLE FOR MEDICINE, a LUBRICANT, a POLISH, a VEHICLE FOR PAINTS, a HAIR DRESSING, a COOKING MATERIAL, and

PETROLEUM. Gillum makes the same point with SALT, and generics cannot be prescribed unless one is only interested in a single aspect of the topic. Generics for this type of term will then have to be included at the indexing stage by the indexer and not made mandatory by the thesaurus. This is not always possible where automatic indexing methods are employed. This presupposes that one is not going to use a series of pre-co-ordinated terms such as OIL punch, also FUEL OIL punch, also VEHICLE FOR PAINTS, etc. This generic free term may cause difficulties when we try to apply faceted techniques to possible thesaurus terms, as generics are an inherent part of any classification scheme.

(*x*) *Punctuation*

Punctuation in the vocabulary will be highly restricted.

(*xi*) *Cross-reference*

Relationships among terms will be shown by cross-references, which will aid users in selecting descriptors from the vocabulary. These will indicate those terms not to be employed for indexing and those to be used, including their superordinate, subordinate and co-ordinate relationship. One rather unusual variant on the way these relationships are expressed in a thesaurus is employed by Rolling[51] at Euratom, who uses a graphic display method. He argues that this avoids the heavy duplication of terms inherent in the Engineers' Joint Council thesaurus, which lists under each term all the other terms with which it is related.

5. CONCLUSIONS

From the numerous different approaches that have been discovered in the literature, it would appear that there is no one method that can be used exclusively in the construction of a thesaurus. The investigator proposes therefore to use an amalgam of all these different approaches.

This will entail the consultation with specialists within the Institute. Terms will be generated empirically from three years of *Management Abstracts* (1964–1966) and these terms will then be vetted against the London Business School's faceted classification to see whether facet analysis can help in the way it has obviously aided other compilers.

These terms will then be supplemented by the terms comprising the indexes that have been prepared to the various editions of the Universal Decimal Classification that have been utilized in the library of the British Institute of Management together with the index terms for an internally devised personnel management classification.

When this phase of the research is completed the vocabulary will be ready for *experimental* use in answering inquiries received in the Management Information Department. This will be a debugging period and will be the stage at which users will help in determining vocabulary requirements. On the basis of this it will be possible to decide whether to use more or less pre-co-ordination, including the question of roles and links. It may, if time permits, be possible to do a similar test using identical parameters to those which the investigator[6] previously employed in evaluating role-free and link-free co-ordinate indexing system for metallurgical literature.

This debugging period would, in effect, be the term rationalization period and it would at this stage be possible to see whether heavily posted and lightly posted terms can be dispensed with as suggested by Caponio and Gillum[10] and Rolling[51]. Caponio and Gillum use the example APRICOTS, which being lightly posted could easily be amalgamated under the broader heading FRUIT. However, if this term is an important one from the *user* angle, this argument is not valid and this is one of the questions that would be answered during this term rationalization period.

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Erfarenhet av ett mindre maskin-dokumentationssystem. [Experience from a small information retrieval system.] *Svensk Kemisk Tidskrift*, vol.80, no.2, 1968, p.52–8. Use of IBM 1401 for document-retrieval by keywords; systems IRFOCK-I and IRFOCK-II discussed, and compared with other systems.

SAXL, LEA
Some thoughts about CODEN. (Letter to the Editor.) *Special Libraries*, vol.59, no.4, April 1968, p.279–80. Difficulties encountered in the use of the ASTM CODEN for automation of serial records at Belfer Graduate School of Science Library, New York.

SCHLESS, ARTHUR P., *and others*
Reading guide and index to the cancer-virology literature, by Arthur P. Schless, Marie E. Purdy and Robert E. Stevenson. *American Documentation*, vol.19, no.2, April 1968, p.163–7. By co-operative efforts, approximately 200 investigators are kept aware of useful information in 230 journals in this alerting service. Its low cost, ease of operation, and extensive up-to-date coverage make it an attractive model for other applications.

SCHVEIGER, PAUL, *and* MĂRGINEANU, FLORIN
Cu privire la elaborarea unui sistem de prelucrare a informatiilor in chimia analitică. [Relating to a system of data processing in analytical chemistry.] *Probleme de documentare și informare*, vol.2, no.4, April 1968, p.231–7. The first phase of compiling a thesaurus for analytical chemistry.

SELUCKY, MILAN, *and* JANAK, JAROSLAV
Mechanizovany system trideni literatury o plynove chromatografii a zkusenosti s nim. [A mechanized system for the classification of the literature on gas chromatography and the results achieved.] *Chemické Listy*, vol.62, no.1, 1968, p.11–22.

SHORES, LOUIS
Library technician: a professional opportunity. *Special Libraries*, vol.59, no.4, April 1968, p.240–5. Discusses the need for assistants to fill middle-level library work.

SIMMONS, PETER
Automation in American libraries. *Computers and the Humanities*, vol.2, no.3, January 1968, p.101–13.

SIMPSON, GUSTAVUS S.
The evolving U.S. National scientific and technical information system. *Battelle Technical Review*, vol.17, no.5–6, May–June 1968, p.21–8. Discusses the probable form of the US information system as it will develop in the next decade. The influence of the federal government on the process is also considered.

SLAMECKA, VLADIMIR
Graduate programs in information science at the Georgia Institute of Technology. *Special Libraries*, vol.59, no.4, April 1968, p.246–50. The curriculum is based on the premise that the study of information and information-based processes are not restricted to librarianship or any other field of science or profession. It encompasses a theory-oriented and a design-oriented direction of study.

SLOTE, STANLEY J.
An approach to weeding criteria for newspaper libraries. *American Documentation*, vol.19, no.2, June 1968, p.168–72. A sampling of past use patterns may be able to provide valid, specific weeding criteria for newspaper picture files.

STANWOOD, RICHARD H.
Design and implementation of an integrated information system. *Journal of Spacecraft and Rockets*, vol.5, no.3, March 1968, p.361–2. US Army's integrated information system.

STEER, VINCENT
Designing a house magazine. *Small Offset User*, May 1968, p.273–5. Suggests a suitable format that can also be applied to the design of booklets, brochures, pamphlets, etc.

STÚMMVOLL, JOSEF, *and* FIEDLER, RUDOLF
New wing for the Austrian National Library. *Unesco Bulletin for Libraries*, vol.22, no.3, May–June 1968, p.137–40. Describes the conversion of part of the "Neue Hofburg" into an extension for the Austrian National Library in Vienna.

SZWALBE, JERZY

Kilka uwag na temat finansowania ósrodków informacji. [Comments on the financing of information centres.] *Aktualne problemy informacji i dokumentacji*, vol.13, no.2, 1968, p.8–13.

TALKING to machines at NPL. *New Scientist*, vol.38, no.603, 27th June 1968, p.677–8. A vowel-recognizing system is among the National Physical Laboratory's current projects. There is a possibility of developing machines that will not be confused by regional differences of accent.

TELL, BJÖRN V.

Kemin gar mott ett internationellt informationssystem. [Chemistry on the way to an international information service.] *Svensk Kemisk Tidskrift*, vol.80, no.2, 1968, p.34–8. OECD is studying the possibility of an international chemical information service. The services in five important countries are illustrated.

TJULINA, N.

The foreign librarianship section of the V.I. Lenin State Library of the U.S.S.R. *Unesco Bulletin for Libraries*, vol.22, no.3, May–June 1968, p.141–3. The section studies work in foreign libraries, analyses trends in the development of librarianship abroad and keeps Soviet specialists informed about these matters.

VAN ALLEN, NEIL K., *and* GIBSON, ROBERT W. JR.

System on automotive safety information. *Special Libraries*, vol.59, no.4, April 1968, p.251–7. The system (SASI) was established at General Motors Research Laboratories to collect and organize all published information relating to automotive safety and automotive air pollution.

VARGA, D.

Postroenie novoi analiziruyushchei sistemy predlozherii. [Building a new system of sentence analysis.] *Nauchno-tekhnicheskaya Informatsiya*, seriya 2, no.4, 1968, p.17–23. Report on the work of the Group for Documentation Linguistics at the Computing Centre of the Hungarian Academy of Sciences, whose chief goal is to develop a new system for automatic analysis of scientific and technical texts.

A VISIT to the Helsinki School of Economics Library. *Kirjastolehti*, no.5, 1958, p.176–7. The library stock consists of 70,000 volumes and 600 current periodicals. Information services are provided.

WERDER, HORST

Methodik der Erarbeitung des Gesamt thesaurus Elektrotechnik. [Method for the compilation of the complete thesaurus for electrical engineering.] *ZIID Zeitschrift*, vol.15, no.3, June 1968, p.128–30.

WIEDLING, STEN

Dokumentationssystem för farmaci och medicin. [Documentation systems for pharmacy and medicine.] *Svensk Kemisk Tidskrift*, vol.80, no.2, 1968, p.47–51. Medlars and Ringdoc described and results of searches discussed.

WOLK, L. J. VAN DER

Telex/microfiche method for transfer of information. *Microfiche foundation newsletter*, no.16, May 1968, p.2–6. Outlines the advantages of telex and microfiche and their combined use for the rapid communication of information.

WOODS, R. G.

Use of an ICT 1907 computer in Southampton University Library. Report No. 3. *Program*, vol.2, no.1, April 1968, p.30–3. Operation at Stage I and preparation for Stage II of the automatic control of 80,000 loans a year.

MEMBERS' ADVERTISEMENTS

Acceptance of advertisements for publication in Proceedings *does not imply Aslib support for or endorsement of the goods or services advertised.*

The charge for advertisements in these columns is 4*d* per word, minimum 5*s*. An additional charge of 6*d* is made for the use of a box number.

AUTHORITATIVE TECHNICAL TRANSLATIONS from French, German, and Dutch into English and from English, French and German into Dutch, specialities electronics, optics, instruments, photography. API Ltd, director K. S. Ankersmit, FIL (French, German, English), 19 Godstone Road, Purley, Surrey. BYWood 3781.

TECHNICAL SWEDISH, DANISH NORWEGIAN translated by J. T. Craddock, B COM, FIL, Ekard, Ray Park Avenue, Maidenhead, Berks. Maidenhead 24931.

WILFRED E. GOODAY, ARSM, DIC, MIMM, FIL. Member of Translators' Guild, Romanian and French. 161 Rivermead Court, London SW6. RENown 1912.

TECHNICAL TRANSLATIONS from Russian, German and Polish into English. B. Klipstein, B SC(HONS), 1 Glenview Grove, Shipley, Yorkshire. Tel. Shipley 58215.

TECHNICAL AND COMMERCIAL translations from English into Russian. Mrs O. Linsley, 31 Farke Road, Barnes, London SW13. Tel. 01-748 8822.

TRANSLATIONS FROM TURKISH. All subjects. F. P. Scott, 4 Uphill Grove, Mill Hill, London NW7.

TRANSLATIONS: TECHNICAL, SCIENTIFIC, all west-European languages. J. Smuts, B SC (ENGINEERING), FIL, 12 Thorndene Avenue, London N11. Tel. 01-360 7723.

TECHNICAL OR COMMERCIAL translations into/from English, German, Dutch and French. A. M. H. Speller, FIL, NGV, 6 Lakeside, West Ealing, London W13. Tel. 01-998 1045.

TECHNICAL TRANSLATIONS. Spanish French, German. Typescript, camera copy, direct image plates. E. W. Sykes, FIL, 39 West Close, Wembley Park, Middlesex. ARNold 4273.

COMPETENT commercial and technical translations from/into German and English. M. G. Young, FIL, 9 Osborne Road, Enfield. 01-804 4366.

Appointments vacant

THE BRITISH COUNCIL

LIBYA

THE UNIVERSITY OF LIBYA, BENGHAZI AND TRIPOLI requires by September, 1968, ASSISTANT LECTURER IN ENGLISH for the Faculty of Arts and Education at Benghazi, and ONE LECTURER and ELEVEN ASSISTANT LECTURERS for the Faculties of Agriculture, Engineering Science, and Teachers at Tripoli. Candidates should have a degree from a university in Britain and relevant teaching experience. A diploma in teaching English as a foreign language would be an advantage. Five of the posts at Tripoli require language laboratory experience; for the posts in the science faculties candidates should have a knowledge of scientific terminology.

Salary: Lecturer: L£3,000–L£3,500 p.a. Assistant Lecturers: L£2,400–L£2,800 p.a. (Libyan £0.855 = £1.) Accommodation allowance. Children's allowances. Gratuity after two years. Medical scheme. Employer's superannuation contribution paid. Fare and baggage allowance for Lecturer/Assistant Lecturer, his wife and up to three children. U.K. leave fare paid if contract renewed. Two-year contract guaranteed by the British Council. Reference 8 PU 35.

THE UNIVERSITY OF LIBYA, TRIPOLI, requires a LIBRARIAN for the FACULTY OF SCIENCE by the beginning of September, 1968. Candidates should have a degree, preferably in science subject, and experience of library work, preferably in an institution of further education. Experience in the classification of scientific books would be an advantage.

Salary: Libyan £2,400 per annum, less 8 per cent tax. A salary of £3,000 per annum may be paid to a Librarian with an Honours degree and Diploma in Librarianship. (Libyan £0.855 = £1 sterling.) Gratuity on completion of contract. Housing allowance. Medical scheme. Children's allowances. Employer's superannuation contribution paid. Fare and baggage allowance for Librarian, his wife and up to three children. U.K. leave fares if contract renewed. Two-year contract guaranteed by the British Council. Reference 8 PU 31.

Write quoting relevant reference number to Appointments Division, The British Council, 65 Davies Street, London W1, for further particulars and application form, to be returned completed as soon as possible.

OXFORD UNIVERSITY DEPARTMENT OF EDUCATION. Information Research Fellowship supported by the Office for Scientific and Technical Information. Applications are invited from suitably qualified librarians or information specialists for a research fellowship tenable for three years from 1st January 1969 or earlier. The appointee will work in conjunction with the editor of *Sociology of Education Abstracts* on evaluation and preparation of documentation and information systems for the sociology of education. He or she will also be concerned with the development of an indexing and retrieval system for the *Abstracts*. Salary will be fixed at an appropriate point on the Oxford University scale for lecturers (£1,470–£2,900). The research fellow will be required to join FSSU. Candidates will also be considered for a Research Fellowship at St Cross College. Further information may be obtained from Dr D. F. Swift, Department of Education, 15 Norham Gardens, Oxford, to whom applications must be sent before Friday 6th September 1968.

An ASSISTANT LIBRARIAN is required at the Paint Research Association Laboratories, Teddington. This library has the most comprehensive collection of literature on the surface coatings and related fields in Great Britain and services research needs, member inquiries and an abstract service having world-wide recognition. Facilities and conditions of work are excellent. Applicants should have 'A' level passes in scientific or technical subjects and have experience of work in a technical library. Salary will be according to qualifications and experience. Applications to: The Secretary, Paint Research Station, Waldegrave Road, Teddington, Middlesex.

SIMON ENGINEERING LIMITED have a vacancy in their Research Department for a LIBRARIAN to be responsible, under the general direction of the Head of the Library and Information Section, for the day to day running of the Library, including the supervision of assistants. Applicants should preferably have passed the Registration Examination of the Library Association and have some experience of working in an industrial or scientific library. Apply in writing to: Personnel Officer (Female), SIMON ENGINEERING LIMITED, Cheadle Heath, Stockport, Cheshire, quoting reference SC.92/1.

Group Technical Information Officer

PILKINGTON Research and Development Laboratories at Lathom wish to recruit a Group Technical Information Officer to establish and operate a centre for storing and retrieving group technical information, operating the existing R. and D. Information Section, advising divisions and technical function on systems appropriate to their needs, keeping informed of technical information services and data retrieval systems provided by other organisations, selective dissemination of technical information and operation of technical libraries.
To lead the centre, they require an honours degree graduate in Physics or Chemistry, aged between 30 and 40 years, who has had substantial experience in the use of modern methods of storing and retrieving technical information.

Applications giving details of qualifications and experience to be addressed to **C. J. Galletly, Pilkington Brothers Limited, Prescot Road, St. Helens, Lancashire.**

PILKINGTON GLASS

PILKINGTON

Technical & Commercial Information

There exists an unusual opportunity for a young woman, aged approximately 21-25 years, to join the expanding information service of a major chemical plant contractor. The opportunity to participate in the application of a computer to the creation of sophisticated storage and retrieval systems may be available to the successful candidate.

The minimum qualifications are H.N.C. in chemistry and a qualification such as A.I.Inf.Sc. in information work. Previous experience of information work and at least a basic knowledge of co-ordinate indexing are essential.

Good salary. 5-day week. Luncheon vouchers. 3 weeks holiday with pay. Please send details to:

The Personnel Manager,
C.J.B. (Projects) Ltd.,
C.J.B. House,
Eastbourne Terrace, London W.2
quoting reference Lib/KB.

ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 **September 1968** **Number 9**

ASLIB CALENDAR 1968

October

TUE.1.	Midlands Branch Meeting: Economics of microfilming.
TUE.1 – FRI.4.	Course: Introduction to mechanization.
WED.9.	Chemical Group: symposium on toxicity.
THU.10.	One-day conference: Engineering Information Services.
FRI.11.	Technical Translation Group meeting: Discussion on the evaluation of foreign matter, technique, etc., for translation.
MON.14 – THU.24.	Senior Introductory Course.
WED.23.	Evening meeting: programmed learning.
THU.24.	Northern Branch/BSI (Associates Section) joint meeting. See paragraph below.
MON.28 – WED.30.	Course: Dissemination of information.
WED.30.	Engineering Group Meeting. Engineering data sheets, by Dr A. J. Barrett.

November

FRI.1.	Course: Foreign language dictionaries.
MON.4 – FRI.8.	Course: Systems analysis.
TUE.12.	Chemical Group Conference. See paragraph below.
TUE.19.	Midlands Branch Meeting: Patents and standards in information work.
TUE.19 – FRI.22.	Course: Mechanization of housekeeping routines.
THU.21.	Engineering Group Meeting: Microfiching of periodicals.
TUE.26 – FRI.29.	Course: Introduction to business records.
WED.27 – THU.28.	Course on work with patents. Birmingham.

December

WED.11.	Scottish Branch party.
MON.16 – WED.18.	Course: Literature of food and agriculture.
WED.18.	Aslib Christmas Party.

Evening Meeting: Programmed Learning

At the evening meeting on Wednesday 23rd October Mr W. Messenger of the Training and Education Department, of ICI Fibres Ltd, Pontypool, and Mr C. D. Batty, Head of the Department of Information Retrieval Studies, College of Librarianship, Wales, will speak on 'Programmed Learning'.

Mr Messenger will discuss the broad principles of the subject and describe how these have been applied in a small industrial training unit where programmes have had to be devised internally. Mr Batty has successfully applied programmed learning to the teaching of classification and has several published programmed texts to his credit. He will discuss the application of the technique to the teaching of librarianship and information work and of library use by readers.

Chemical Group/ECMRA joint conference

The joint one-day meeting with the European Chemical and Market Research Association on Tuesday 12th November, which we mentioned in the June issue of *Aslib Proceedings,* will be held at Quaglino's, Bury Street, SW1.

Speakers will include Dr D. W. Mill (Shirley Institute), Mr R. Lees (Ministry of Technology), Mr S. Madeloff (Compendium Publishers), Mr B. N. P. Hutcherson (BP Chemicals), Mr L. S. Adler (Chemical Industries Association), and Miss H. G. Humphrey (OECD).

Registration forms are available from Mr E. F. Broome, Beecham Products UK, Lucozade Annexe, Great West Road, Brentford, Middlesex.

Programme for future Aslib Meetings and Conferences

From time to time in the past, members have made suggestions for subjects which they would like to see included in the programme of Aslib meetings and conferences. This kind of co-operation is very helpful and it is much hoped that in the future still more members will come forward with requests for specific subjects for programmes. These are welcome at any time, but most of all in the early autumn, when the committees are beginning their work for the new season.

Suggestions should be made in writing and addressed to Aslib for the attention of the Meetings Organizer.

Northern Branch

BSI Standards Associates Section, Northwestern Region, will hold a joint meeting with the Northern Branch at the Building and Design Centre, 115 Portland Street, Manchester, at 6.30 p.m. on Thursday 24th October.

Mr S. Hudson, Head of the Technical Information Division of BSI, will speak on his work and on the classification and retrieval of technical information.

Prices of periodicals

The annual index to periodical price increases compiled by B. H. Blackwell Ltd of Oxford is once more appearing in the August issue of the *Library Association Record.* The complete statistics are analysed into sixty subject divisions of which the totals are reproduced below. Off-prints of the statistics and the accompanying article will be available in September from the Periodicals Department, B. H. Blackwell Ltd, Broad Street, Oxford. Off-prints are still available of the articles published in preceding years.

Journals priced between 10s and £25

Subject	*No. of titles*	*Average price 1968* £	*s*	*d*	*Percentage increase on 1967*	*Increase on 1965 (100)*
Humanities and Social Sciences	663	4	3	5	16.7	132.1
Medicine	188	7	16	3	17.2	136.5
Science and Technology	810	7	13	9	18.5	133.8
Total	1,661	6	5	11	17.8	133.6

All prices

Subject	*No. of titles*	*Median price 1968* £	*s*	*d*	*Percentage increase on 1967*	*Increase on 1965 (100)*
Humanities and Social Sciences	671	4	11	1	16.7	134.7
Medicine	197	9	19	6	17.7	137.3
Science and Technology	898	12	17	3	21.4	144.1
Total	1,766	9	5	3	20.1	141.3

ANALYSIS BY COUNTRY OF ORIGIN

(*Journals priced between 10s and £25*)

Country	*No. of titles*	*Average price 1968* £	*s*	*d*	*Percentage increase on 1967*	*Increase on 1965 (100)*
Great Britain	752	5	8	6	11.1	128.3
USA and Canada	522	7	2	8	22.6	137.6
Other countries	387	6	17	5	22.5	137.1

Economics of Microfilming

A one-day seminar on the economics of microfilming and document reproduction will be held at the University Arms Hotel, Cambridge, on Friday 27th September 1968. It is organized by the Microfilm Association of Great Britain.

The speakers will include Mr W. D. Linton, of the Science Library, Belfast, Mr A. W. Martyn, of HMSO, and Mr E. H. Graham of *World Microfilms*.

The fee is £4 4*s* for non-members of the Association. Further information may be obtained from the Microfilm Association of Great Britain, 19/27 South Street, Farnham, Surrey.

Senior Introductory Course to Special Library and Information Work

The Senior Introductory Course to Special Library and Information Work will be held from Monday 14th to Thursday 24th October 1968, at Aslib Headquarters. It is intended for graduates or students with comparable qualifications or experience in other fields who have recently entered special library or information work. Its aim is to give students a broader view of their work than can be obtained by working in a single department, and to suggest ways in which they can increase their knowledge and understanding of information and library work. The course has been extensively revised, and a new feature is the provision in certain sessions of alternative programmes for those working in scientific and technical subjects and those in the field of the social sciences. The course includes lectures, discussions and visits to libraries and information departments. The fee for the course will be 27 guineas.

A programme and application form are enclosed in this issue, and students are advised to apply early. Provisional bookings will be accepted by telephone or telex. In general only students possessing a degree or comparable qualification will be accepted. Other students who wish to attend should consult the Education Officer before sending in their application.

Course on Foreign Language Dictionaries

On Friday 1st November Aslib will present a new one-day course on Foreign Language Dictionaries. This course is designed to meet the needs of information and library staff, rather than those of translators, though budding translators might benefit from it. The subjects covered include the history and varieties of dictionaries, the making of dictionaries, the availability of dictionaries and the use of dictionaries. Both the Aslib Technical Translations Group and the Institute of Linguists have collaborated in the presentation of this course. The fee for the course will be 3 guineas. A full programme is enclosed in this issue, and applications should be made on the form enclosed in it. Provisional bookings may be made by telephone or telex to the Education Officer Aslib.

Research in progress

In the 1968 issue of the *Library Association year book*, p. 84–97, a brief listing of the major library and information research projects currently in progress in this country, together with a note of projects recently completed, appeared for the first time. General information on current research was not readily available in a convenient form until the appearance of this register, and it is proposed to keep the list up to date, since it has proved to be a useful tool for the profession.

All institutions and individuals known to be engaged in major pieces of library and information research have already been circularized with a request to supply certain basic details of their research for the 1969 listing. It may well be, however, that some have been overlooked, and any reader of this note engaged in such research and who has not received an information form is requested to get in touch with the Research Officer, The Library Association, 7 Ridgmount Street, London WC1, as soon as possible.

Northern Aslib Bulletin

Will members please note that the last issue of *NAB* to be published was No. 1, 1967. When a further issue appears members will be notified in these pages.

ASLIB CHEMICAL GROUP—A REPORT OF CURRENT ACTIVITIES

Chairman:	Mr B. T. Stern (The Wellcome Foundation).
Hon. Secretary:	Mr A. R. Dodd (Porous Plastics Ltd).
Hon. Treasurer:	Miss F. M. Baker (Shell Research Ltd).

The activities of the Aslib Chemical Group during the last two years have developed mainly as a result of recommendations evolving from the Attingham Park Conference, held during April 1967, the proceedings of which were summarized in *Aslib Proceedings* 19 (8) 272-7 (August 1967). Many of these recommendations have proved themselves to be of wider significance than was at first realized when they were formulated within the confined definition of the Chemical Industry, and it is felt that many Aslib members outside the Chemical Group will be interested in some of the current projects which have arisen as a result.

Market Research and Commercial Intelligence

Throughout Europe during the last decade there has been a growing need from every quarter of industry for commercial information of all types. The difficulties in collecting such data and the inadequacy of certain areas covered by existing facilities are rapidly becoming the concern of all.

In an effort to clarify the problem and investigate possible solutions, the Chemical Group is actively engaged on two ventures:

1. Close liaison with the European Association for Industrial Marketing Research (EVAF) has resulted in the announcement of a joint one-day conference to be held at Quaglino's on Tuesday 12th November, plans for which are well advanced.

2. A second conference planned for April 1969 which was briefly announced in *Aslib Proceedings* 20 (6) 262 (June 1968) will be held under the auspices of the Chemical Group alone and it is hoped that both conferences will result in further projects.

Such is the importance of commercial information to industry in all countries that inquiries about both conferences have already been received from New Zealand, Japan, Czechoslovakia and the USA.

Arrangements for the November conference are in the hands of Mr J. Clew (The Electricity Council) and Mr E. F. Broome (Beecham Products (UK) Ltd); those for the April conference are the responsibility of Miss F. M. Baker (Shell Chemical Company Ltd), Mr B. T. Stern (The Wellcome Foundation) and Mr A. R. Dodd (Porous Plastics Ltd). Mr F. L. A. Handovsky (Esso Chemical SA) is acting as European Liaison Officer for both conferences.

Translations

It is felt that the results of scientific research published in Russian, Far Eastern and other foreign journals are readily available in Western countries through the medium of the many cover-to-cover translations which are published. There are not, however, the same facilities for those who are primarily involved in technology as opposed to research.

Many foreign articles in the technological field are reported in the various abstracting journals, but discussions have indicated that technologists are happier looking at full articles together with their graphs and diagrams than reading abstracts.

This problem has been brought to the attention of OSTI, Mintech, the National Lending Library for Science and Invention, and the National Lending Library, all of whom are concerned about the situation. Representatives of the Chemical Group and the organizations listed have already held a preliminary meeting to identify the problem areas, and to discuss ways in which possible solutions can be obtained. At that meeting it was agreed that, as a first step, a specific area should be selected, and the technological journals covering the subject be ascertained. Initially Japanese technological journals will be examined of which there are thought to be 700, not all of which, however, will be of prime importance. It is hoped that this exercise will result in a small pilot investigation, possibly with Government financial support, to provide a bulletin of expanded titles in English that will enable information officers to judge if a particular paper is worthy of translation on a cost-sharing basis with others interested in the same paper. The Chemical Group has agreed to initiate the investigation and to guide the project through its early stages.

Toxicity legislation

The difficulties involved in obtaining information about British and foreign legislation relating to products are almost insurmountable at the present time. This is a subject which has been brought to the notice of members of the Chemical Group on numerous occasions.

Those who are not experienced in this field might well imagine that an authoritative answer is readily obtainable from published Government documents, or by direct inquiry to a particular Government Department or professional body. This is certainly not the case.

In Europe at the present time the EEC are still trying to reach agreement on a series of transitional regulations pending full agreement of Common Legislation under article 100 of the Treaty of Rome. These transitional regulations should have come into force on 30th July.

The situation in the USA, which is governed by the US Food and Drug Administration, has been described as inconsistent, complex, and virtually incomprehensible, particularly those regulations concerning the use of packaging materials for food and drink. Recently, however, an authoritative source has indicated that a major change can be expected in future US legislation.

The UK situation is equally confusing. The Pharmacological Sub-committee of the Ministry of Health and the Food Additives and Contaminants Committee of the Ministry of Agriculture, Fisheries and Food are the source of UK legislation, but at the present time little attempt appears to have been made to collaborate and harmonize with other countries. A joint EFTA/EEC Toxicity Committee set up some years ago for this purpose is now virtually inactive due mainly to the intransigence of one of the countries concerned.

Following discussions with the British Industrial Biological Research Association, a half-day meeting has been arranged for Wednesday 9th October, in London, when an attempt will be made to throw some light on this very difficult subject.

On this occasion BIBRA are providing two very knowledgeable speakers and ample time will be given to discussion. Details of this meeting are to be found in *Aslib Proceedings* **20** (7) 298 (July 1968).

Aslib research

Several members of the Group have, from time to time, expressed interest in the special projects under investigation at Aslib and the Director has on several occasions invited ideas for consideration. At the Group's annual general meeting in 1967 this topic was given a considerable airing, and as a result two special officers were appointed to act in a liaison capacity between the Group and the Aslib Research Department.

Suggestions were invited from Group members for consideration as possible projects for Aslib to undertake, but the results were disappointing. It became clear that one reason for this apparent diffidence was a lack of knowledge of the work of the Research Department and of its current research programme.

This matter was taken up with the Assistant Director (Research), who readily expressed willingness to issue regular statements in *Aslib Proceedings*. The Chemical Group are therefore particularly pleased to see the detailed programme presented in the July issue, and look forward to regular progress reports on the topics therein. In addition, Mr Vickery has also agreed to present a paper, detailing the Aslib Research Programme, at a meeting at Aslib on 29th January 1969.

Mr P. Cole (British Petroleum Ltd, BP Research Centre, Sunbury-on-Thames) is the Group's Research Liaison Officer and will welcome inquiries from interested persons in connection with this meeting.

Commonwealth Agricultural Bureaux

Discussions have been taking place between the Chemical Group representatives and the Directors of the Commonwealth Agricultural Bureaux concerning the possible application of computer techniques to the production of CAB literature.

These discussions arose out of an Attingham Park recommendation 'that more effort should be devoted, e.g. by CAB, to compiling current published information relating to specific pests and diseases of economic importance and that CAB should consider the provision of more current awareness services'.

Those who are familiar with CAB publications will appreciate the vast amount of work which would be necessary to put these proposals into practice, especially if mechanized methods were to be introduced. It suffices to say that the CAB are now well aware of the Chemical Group's views on these matters and will take them into full consideration when establishing future policy.

Mr H. Dammers (Shell Research Ltd, Woodstock Agricultural Research Centre) and Mr E. Broome (Beecham Products (UK)) are representing the Group on this project.

British Standards Institution

The Group have agreed to assist the BSI in the revision of the UDC tables 54 and 66, Chemistry and Chemical Technology. Two meetings have so far taken place.

At this stage members are endeavouring to improve the English terminology of sections 66/66.099. This will inevitably become a very long term project but with obvious worthwhile results.

Chemical Group are represented by: Mrs M. Meiklejohn (BP Chemicals Ltd), Mrs K. Bourton (Constructors John Brown Ltd), and Mr E. F. Broome (Beecham Products (UK) Ltd).

Education

Considerable enthusiasm for courses in chemistry and polymer science for non-chemists, i.e. librarians and information officers operating in these fields, has been shown since the idea was first mooted in 1965. The first course was established during 1966 when members of the Group were invited to attend courses run by the late Mr Chubb, by courtesy of Shell Research Ltd.

With the untimely death of Mr Chubb last year the courses ceased, and since that time the committee have been seeking alternatives. Three possibilities are being considered.

A Polymer Science Course is being specifically designed for the Chemical Group by Professor Reynolds at the Institute of Polymer Technology at Loughborough University and will be of three to five days duration. Professor Reynolds, in liaison with the Chemical Group's Education Officer, Dr H. C. Evans (Shell Research Ltd, Carrington Plastics Laboratory, Urmston, Manchester), is prepared to adjust the level of the course to the Group's requirements. It is intended to offer as much individual tuition as possible and to provide adequate opportunity for practical work. This course is planned for the spring of 1969, and announcements will be made accordingly.

The Chemical Group has also been offered the opportunity of taking up places on courses, covering different aspects of the chemical sciences, which are already run on a regular basis at two colleges. Both are willing to discuss possible modifications to the existing syllabuses for the benefit of the Chemical Group members, and in each case Dr Evans is critically assessing the subject coverage. The courses are offered by the Leeds College of Commerce and the Borough Polytechnic respectively.

Liaison

Interested members are invited to contact the Group regarding further details on any of the topics mentioned. Where activities may be of interest to other Groups, the Chemical Group Committee is making sure that full details are circulated. Possible co-operation and liaison with any other Group Committee will be welcomed.

AN INDUSTRIAL PATENT AGENT LOOKS AT HIS WORK

J. A. D. CROPP

Evening meeting at Aslib, Thursday 23rd May 1968

I HAVE found that to be able to do proper justice to the theory and practice of patenting, a minimum of three hours' dissertation is required. My voice, like your interest, would meet a nasty end long, long before that time had elapsed. Consequently, I propose to spend a few minutes providing a rough pencil outline of patent philosophy and then sketch in a little more detail the area where the patent expert and the information retrieval expert need to co-operate.

Patent Agents

Before I dive in, however, I think I ought to state my terms of reference. Those whose duty it is to guide the layman through the intricacies of patenting are divided into two parties; those in private practice and those in industrial (or tied) practice. Patent agents in private practice act for many clients whose interests range over a wide technological area. They therefore have to rely very heavily on the expert for information on the state of the art, and historical background, in any particular area. Some agents in private practice retain their own information retrieval sections; others, probably the majority, rely on the services of the specialist information retrieval business. The tied patent agent, on the other hand, has but one client, his employer. His practice, as a consequence, is generally in a relatively small area of technology and his general reliance on the information retrieval expert is that much reduced. It has by no means disappeared, however, because information retrieval, even in this reduced area of responsibility, can be a full-time job for one or more experts.

I am a tied patent agent, but because I deal with the innovations and discoveries of a long-range research laboratory with a very general remit, my practice is more akin to that of a private patent agent. Looking over the inventions that have been made in the Laboratory over the last three years, I find that they range from simple devices for use in domestic water supply systems through mass spectrometer parts, internal combustion engines and artificial organs for animal and human bodies to polymer technology, organometallic chemistry and biochemistry.

As a consequence, I have to rely to a very large extent on information retrieval by others, both from within the company and from exterior sources.

Before I was associated with this Laboratory, my practice was typically that of a tied agent; I was responsible for a very narrow area of polymer technology. I therefore feel reasonably confident on being able to talk on both aspects.

I have implied that if the layman is to become involved with patent matters he must consult a patent agent. There is no legal compulsion. An inventor can file his own patent application and pursue his own patent, even representing himself in the Patent Office court. However, for a layman to attempt this is like asking a foreigner to London, with no knowledge of English, to find a particular cul-de-sac in one of the more mediaeval areas of the city. Even a rough general knowledge of the town is little help and can even be a definite hindrance because of the peculiar twists that the old streets take. A map is not of much help in the absence of an understanding of the language. Patents have an ancient history and the published laws and rules, even right up to date, are no more than a general guide. It is necessary, particularly, to know how the laws and rules will be interpreted in the Courts and this is the job of the patent agent. Even in my own limited experience, I have known very intelligent men make catastrophic and, to the mind of the trained expert, very elementary mistakes of interpretation or judgement when venturing into the patent field. And I have known of such mistakes which have turned out to be very expensive.

What is a Patent?

Patents have a very long history indeed. Even the Greeks practised a monopoly system of sorts. Many years BC they are known to have awarded monopoly grants to inventors of new food delicacies—obviously they had their priorities right.

In this country, patents first developed as grants of monopoly rights from the Crown to favourites. Originally, invention was not always involved, the system being more a means of rewarding faithful retainers by providing them with a trade with which competition was banned by royal decree. Inevitably, the system was abused and fell into disrepute, and in the early seventeenth century by Act of James I, all patent monopolies were decreed void with the sole exception of those granted to subjects providing new industries, whether by invention as such or by bringing back from foreign parts knowledge of an industrial development hitherto unknown within these shores. Even today, incidentally, there is provision for invention by importation although with the speed of communication nowadays this manner of 'invention' is virtually extinct and the provision is usually only invoked for technical reasons in certain circumstances.

There have been many changes to the Laws governing patents since the Act of James I and even now still further changes are under consideration; changes that are desirable and necessary if the patent system is to be of value against the modern background of speedily advancing technology. However, even today the Patent Laws are based on the Statute of Monopolies enacted by James I.

The philosophy behind the patent system is quite simple. The patent is a reward for a contract. The contract (in this country) is between the Crown and the applicant for the patent. The basis of the contract is that in return for making public his invention in such a way that any person having some knowledge of the art in which the invention has been made may repeat the invention and reap the technological benefits claimed by him, the applicant may obtain a monopoly in the operation of the invention. The monopoly is limited geographically (international patents do not exist yet) and temporally and it can be taken away if annual taxes are not paid or if it is misused. But while the monopoly remains in force, the owner (that is, the patentee) has the right to prevent anyone else operating his invention without his permission. The patent does *not* give the inventor the right to operate his invention—that is a right he always had—unless another patent exists within the scope of which he would have to operate if he wishes to work his invention.

Despite the geographical, temporal and other limitations touched upon above, however, the patent can be a very valuable commercial asset and likewise the absence of suitable patent protection can be a severe commercial embarrassment.

Patents can be used just like any other property. They can be bought, sold, mortgaged (although I have found no actual instance of this), and rented (i.e. licensed).

In general, patents may be granted on processes for making, or improving products or on preventing them from deterioration, and on products themselves, for example machinery, apparatus or chemicals. To obtain a patent, the process or product must be new and not such as to be an obvious modification or improvement on what has been done before. It must also be capable of industrial application. For example, an idea is not patentable although the particular application of that idea might be. Computer programmes are not patentable and nor are rules of games, for example.

Obtaining a Patent

To obtain a patent, the applicant must file a request accompanied by a description of the invention and by a claim to the area for which a monopoly grant is requested; that is, he has to describe precisely and unambiguously the things which he wishes to prevent others doing. The detail of the description (the specification) must be sufficient for one having some knowledge in the general field to be able to understand the invention, operate it himself and obtain the advantages claimed. The claim must be unambiguous, precise, and essentially co-extensive with the invention outlined in the description.

The drafting of the specification and the claims and the interpretation of those drafted by others is the prime job of the patent agent. In cases of dispute the patents may be referred to the Courts and in such cases the specifications and claims are regarded as legal documents just as in the case of documents recording any other contractual obligation. The claims, in particular, require great care in their composition. If they are too wide, they may be found to include what has been done before and will therefore be unenforcible. If they are too narrow, they may be worthless through being easily evadable.

Because of this, the drafting of a patent specification and claims should be left to the expert and likewise with the interpretation of the specification and claims.

As most, if not all, of you will know, in most major industrial countries, after a patent application has been filed the specification and claims are examined and a search is made to see whether the invention is new. In some countries, the specification is also examined to see whether the invention, even if strictly new, is patentably different from what has been done before. The thoroughness of the search varies from country to country. In this country, for example, only

British patents are searched although the examiner may cite any other publication which he may happen to know of. In the USA, on the other hand, the search is theoretically at least through all published literature.

As patents are national, an inventor who wishes to control his invention internationally must seek patent protection individually in each country in which he is interested. With today's tendency towards large plants serving international markets, and with the ever-increasing rate of advance of technology, more and more patent applications are being filed in more and more countries. The Patent Office of each country, therefore, is working under greater and greater strain. The answer, in theory, is obvious. Why let the same invention be examined several times over, that is by Patent Offices in each country in which patent protection has been sought. Why not seek some sort of co-operation between Patent Offices. As you will know, there is a co-operation treaty between examining Patent Offices—it goes under the name ICIREPAT. However, its members are finding that co-operation is not easy. A fundamental difficulty is that of language. Despite this, advances are being made and there has existed for some years the International Search Bureau at the Hague. It is believed by many that this Bureau will have to become the nub of any full co-operation on searching between the world's Patent Offices. Certainly, it is my opinion that co-operation between Patent Offices in this field will have to advance quickly in the next few years if the patent system is not to fall into disrepute. Industry wants a patent system which publishes patent specifications speedily and has been able to treat each patent application to such rigorous examination that one can place a good deal of reliance on the generalization that a granted patent is likely to be a valid patent. At present it is generally the case that neither requirement is met. Patent specifications can take many years between filing and issue and in this country at least a considerable number of largely invalid patents are granted each year.

I for one do not believe that the present trend in many countries towards publication of the patent specification shortly after filing, followed by examination at some later date, is likely to alleviate the situation, and it is going to face the information retrieval expert with a king-sized problem to achieve adequate coverage of the ever-increasing rate of publication of patent specifications that this will create, even if many of them cover the same invention but in different countries.

But I digress, once the patent specification and claims have been accepted by the Patent Office, they are published and, if no one opposes them, grant of patent follows a few months later and the granted patent becomes a pride and joy to its owner and a potential thorn in the flesh to a hundred and one other companies active in the same field.

The Role of Information Retrieval in Patents

The work of the patent agent, then, is involved on the one hand with the preparation of patent specifications, their guidance to grant in the Patent Offices of the world, and their exploitation and enforcement after grant, and on the other hand with the examination of patents that potentially might interfere with his client's business or intended business.

Both these activities require a close knowledge of the history of technological development in the field concerned.

Even if the patent agent has only a relatively small area to control, he still cannot possibly be personally aware of all the prior art in his field or keep himself abreast of all publications in his area. Take polyolefins as a sphere of activity, for example. Even though only a species of the genus 'macromolecule', the polyolefin has a complex history and the number of articles published on it in all its aspects from synthesis of the monomer to application in, for example, a specially treated form as insulation on a submarine cable, or as a flight for a dart, must run into many thousands.

It is at this point, therefore, that the embarrassed man, whose prime job in life is after all obtaining and examining patents, has to seek for aid. His most hopeful way of keeping abreast of publication is by the perusal of abstracts. He therefore seeks to provide himself with this source of easy knowledge and it is the Information Officer who, in most cases, manfully fills the need.

Current Awareness

The patent agent requires *current awareness* for two basic purposes.

1 Primarily to spot the publication of patents that are a potential hindrance to his client's activities.

2 Secondarily, if he has the time, to keep himself abreast of the technological trend in his field.

To fulfil the first need, the patent agent requires the abstract to summarize accurately the broadest scope of the patent. This is most simply done by repeating the main claim or main claims. It is, therefore, in my opinion essential for the Information Officer to be aware of how to look for the main claim of a patent. Many patents have more than one main claim and often enough the claim the agent is interested in is not no. 1. For example, a patent may have a main claim to a new kind of ducting, part of which could be made from any strong synthetic resin. It may also, quite legitimately, have a further claim (say claim forty-five) to a novel synthetic resin particularly suitable for the application. The unwary Information Officer abstracting the patent may miss the claim to the synthetic resin. The patent agent, relying heavily on his Information Officer, also misses it, and is consequently unable to warn the Research Department that their efforts to make this new synthetic resin have been overtaken by events. Of course, if the Research Department carries on and develops the resin and the company wishes to manufacture, a proper search at this later stage should correct the error, but the damage has been done. If the patent is strong and the patentee unwilling to licence, that much research money and effort are wasted. In most Research Departments there is insufficient of either to cover all the projects the management has in mind; the loss, then, is doubly bad, since both effort and expense could have been diverted to another, more promising, topic.

When the Information Officer is working within a particular area, therefore, he must remember two things: the Patents Department wants the abstract to reproduce as faithfully as possible the scope of the patent and it wants to know that all patents having claims in the filed of interest have been included. The key-word, therefore, for abstracting in this area is *precision.*

A patent can only be granted for something new and therefore it is generally true that a newly granted patent cannot stop you doing what you are already doing—with one important proviso. The patent is established from the date on which it was filed in the country in question, or (in certain circumstances) the date on which it was first filed in any country. If, therefore, your client begins some new activity or starts to build a plant to produce a new product in the interim period between the filing and the publication of the patent specification, he can be caught very expensively. It is essential, therefore, to have a good early warning system. In this country, the period between filing and publication can approach four years. In many other countries, however, particularly Holland and now Germany, publication can occur within six months of filing. The patent agent therefore also wants to watch activity in these early publication countries in the hope that the invention has been filed in one of them. Often enough, the inventor is anxious to have his invention published early, either so that he can attract licensees or so that he can steer potential competition away, and he will therefore generally file a patent application in an early publication country. That is why so much interest exists in the publication of patents in Holland, France, Italy, Belgium and, soon, Germany. The Scandinavian countries are now following, with the USA in hot pursuit, although legislation in the USA was tripped up at the first fence.

Information supplied to fulfil the second need of keeping abreast of technological trends need not be so precise in its presentation. For the patent agent, time is at a premium. He wants to cull the maximum possible benefit from the briefest possible synopsis. The art of presenting information to this end is a rare one and the person who can acquire it is a valuable asset to any information organization serving a Patents Department. Nothing is so gratifying to a patent agent as to be able to demonstrate, superficially anyway, that he is as up to date as the research chemist or technologist.

Prior Art and Patentability

The patent agent also wants, from time to time, a very close appraisal of the state of development in a specific area of his interest. The requirement for this is quite different from that involved in a current awareness exercise. In the latter, precise reporting on a broad front is required. In the specific request of the type I shall now deal with, the requirement is usually for a very generalized picture of a specific area, although it often starts as a request for information on a very narrow basis.

This kind of request can arise for one of two reasons.

The first is when an alleged invention has been made and the agent needs to know if it is novel. The question can be drafted very precisely and the answer, in theory, will be absolute. However, theory assumes that the Information Officer has *all* the prior art available and that it has been faultlessly indexed, which is rather a tall order. Still, a reasonable idea of the likelihood of novelty can usually be obtained from what is available.

Novelty, however, is not sufficient for patentability, and it is at this point that the agent will want a more general picture of the area of technology concerned so that he can see how the alleged invention fits in with what has already been done. For this kind of exercise to be successful, it is essential that the Information Officer should be absolutely clear about what the patent agent is after. A thorough and proper briefing by the patent agent and a thorough understanding by the Information Officer are equally essential. It is a problem of communication, and many are the occasions where the scope of the search has been wrongly chosen because of a lack of proper thought and communication at this stage. Only too often, the patent agent has not really thought the problem through and, almost as often, the Information Officer has failed to appreciate the full significance of the instructions given by the patent agent. For example, a search for an additive to obviate some physical defect in a plastic should include not only similar additives for that plastic, but also the use of the same additive on other plastics with the same or a similar defect.

The identical kind of exercise is required when an interfering patent is found and its validity is to be checked. First comes the check for novelty and then follows the examination for obviousness.

The Information Officer

Perhaps one of the most important points to bear in mind when dealing with patents is that their validity can never be considered absolute until the point has been tested in the highest possible court. Another way of looking at this is that even in the case of an invention that is novel and not immediately obvious, the patent is really only as strong as the patentee is prepared to make it.

In opposition to a patent, therefore, the opponent has to decide just how much it is worth his while to break it. This has a bearing on the amount of effort put into searching the literature because I believe that literature searching, in particular, is like Tom Lehrer's sewer: what you get out of it depends very much upon what you put into it. Whatever the time and money you are prepared to put into it, however, the value obtained depends above all upon the astuteness, imagination and sheer burrowing ability of the information expert upon whom the load falls. I feel that there is still too much amateurism in the approach to the manning of information retrieval departments, too much of the attitude in big companies that it is a useful workhouse for the ageing or left-handed research chemist. I find the same attitude to patent staffing. 'Give me a chap with an honours degree in history and I will soon make him a first-class member of a patents department serving a chemical firm.' I have heard it only too often, from regrettably eminent places.

Selection of personnel for information retrieval, in my opinion, speaking as one who leans heavily upon the service, needs as much care as selection for any other specialist occupation, and the sooner this is recognised the better. The basic requirement for the Information Officer is some particular knowledge of the area with which he is to deal. On top of that he needs the inquisitiveness of a spaniel, the foresight of Michelangelo, the doggedness of a sherpa, the patience of Job, and the ability to resist inflicting grievous bodily harm when told that he has not come up with much.

When he does not drive me up the wall, I am his greatest admirer.

DISCUSSION

Miss M. Webb (the Chairman) asked whether, with the present trend towards early publication, the delays apparently avoided would only arise later as the validity of the patent was tested in the courts.

Mr Cropp replied that the arrangements for early publication, now adopted by many national Patent Offices, did not bring with them any concomitant reduction in the time elapsing before a patent specification was examined. The rules usually provided for the applicant, or an interested third party, to request examination at any time up to about seven years after filing, and the request might be made before or after publication. Based on the results of the examination, the applicant would then decide whether or not to continue with the prosecution of his application.

Whether or not the Examining Patent Offices operating the early publication procedure would be quicker in dealing with requests for examination remained to be seen, but his feeling was that if applicants chose to use the procedure on a large scale as a cheap way of assessing the validity of their patent applications, the Patent Offices would become just as swamped as they were now—unless they co-operated on information retrieval and novelty examination.

Mr L. Wilson (Director of Aslib) remarked that if no examination took place between the filing of an application and its publication six months later in the so-called 'quick publication' countries, this scarcely constituted quick publication. Could not publication take place in one month, or two at most?

Mr Cropp replied that in theory there was no reason why this should not be so. In practice, however, there was a limit to the speed with which inventors, or inventive organizations, wanted their innovations published.

Mrs C. Philip (BP Trading) asked whether there was not a need for an international patent, and whether non-patent literature was valuable as a searching source for 'prior art'.

Mr Cropp replied that there was certainly a need for international standardization of patent law and practice, particularly with respect to what constituted prior art, the monopoly gained by the patent, rights of third parties, and period of monopoly, for example. Non-patent literature was often of prime importance in establishing what was the general extent of knowledge in the art at a particular date. The value varied from art to art, however. Some arts were relatively so new and/or of such industrial importance that little literature was found outside patent specifications.

Mr B. T. Stern (BIP) asked to what extent an attempt should be made to draft a master patent, having in mind that with several related applications if one filing was shown to be invalid the related applications might still be valid.

Mr Cropp replied that it was always desirable to try and obtain a master patent: the main problem was time. To be strong, a master patent of fairly wide scope might require a large number of examples, the preparation of which would take time. The applicant had to balance the risk of inadequate exemplification against that of being beaten to the post. Sometimes the situation was right for attempting a 'master patent'; sometimes one would be better advised to settle for sequential patenting of associated innovations.

Another danger of trying to obtain a master patent was that in attempting to write a fairly broad specification on the basis of a limited collection of facts, it was very easy accidentally to destroy the chances of obtaining a valid patent on a particular development which later proved to be of vital interest and was inadequately covered by the claims of the 'master patent'.

Mr L. Clayton (Simms Group Research and Development) asked whether the figure of six months for publication in Holland should not in fact be eighteen months after priority date. Also, were more or fewer specifications with search findings available under renewed, as compared with the old Dutch procedure?

Mr Cropp replied that it was indeed eighteen months. The reference to six months related to the period between filing the specification with claims in UK and publication in, say, Holland. On the second operation, it should be remembered that under the new procedure a third party also has the right to ask for a report on novelty.

Mr A. R. Webb (Smith & Nephew) asked how a patent department was organized in a big company. Did the information department need a knowledge of patent law?

Mr Cropp replied that in general one or more principals would be qualified patent agents and some junior staff were likely to be studying to take the qualifying examinations. There might also be an expert on formalities.

Secondly, he felt that every Information Officer should at least have some idea of the purpose of the patent specification and claims, and preferably also of the grounds upon which a patent could be invalidated for want of novelty, for prior claiming, and for obviousness.

Mr R. M. Douchesne (Birmingham School of Librarianship) asked how effective British national and public libraries were in providing patent literature and information.

Mr Cropp replied that in his own limited experience, however, there seems to be a considerable improvement in the services supplied by provincial libraries. This need was recognized by the librarians and in general requests and complaints had been received most sympathetically.

Mr M. W. Hill (NRLSI) asked the speaker's opinion of the value of publishing two or three versions of the specification (as was the present Dutch and future German practice). Did the benefits of early publication outweigh the inconveniences of starting the vast mass of literature and of having sometimes to compare three very similar documents?

Mr Cropp replied that the only difference between the publications in question, if any, was that of scope of claims and possibly extent of disclosure. In general, the scope of the claims would have diminished in the later publications, but it was not unlikely that the extent of disclosure would have increased, e.g. by carrying a much improved appraisal of the relevant prior art. From the point of view of current awareness, it was important to pick up and record the first publication. It was true that the form of the claims in it might not be entirely indicative of the final scope of the granted patent, but once the early warning signal had been sent to the Patents Department (or other relevant body) it was up to that body to follow the corresponding patent application to grant and check the final scope, if it was of interest. This should not be a matter for the Information Department. From that point of view, therefore, there was no reason why the Information Department should bother with the later publications. From an information retrieval point of view, however, the answer might be different, and each department would have to balance the inconvenience and extra work involved against the improved service thereby provided.

Mr A. G. Woolcott (Woolcott & Co.) asked whether it was not appropriate that the delayed examination procedures now practised in Holland tended to shift the responsibility for examination from the legislator to the applicant or potential infringer, thus rendering unnecessary the examination of many applications which lacked merit or nuisance value to third parties.

Mr Cropp replied that the legislature granted the patents and, in his opinion, had a duty to protect the interests of the public at large. Many sections of the public were very ignorant of patent law and might over-rate the damaging effect on their activities of the publication of a patent specification which deliberately or otherwise had unduly grasping claims. The trend referred to seemed to favour still further the large company that could afford a skilled patents department, and discriminated against the small organization.

Letter to the Editor

NATIONAL LIBRARIES COMMITTEE

Dear Sir,

We refer to the document 'Evidence Submitted to the National Libraries Committee' published in *Aslib Proceedings*, July 1968.

We wish members to know that the undersigned, being then members of Aslib Council, voted against this document. As we were not allowed to attach a minority report to it, we submitted independent evidence to the Dainton Committee.

Yours faithfully,
K. J. BAKER
R. MOSS

17 Cragside, Thackley,
Bradford, Yorkshire.
31st July 1968.

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AUTHORITATIVE TECHNICAL TRANSLATIONS from French, German, and Dutch into English and from English, French and German into Dutch, specialities electronics, optics, instruments, photography. API Ltd, director K. S. Ankersmit, FIL (French, German, English), 19 Godstone Road, Purley, Surrey. BYWood 3781.

TECHNICAL SWEDISH, DANISH, NORWEGIAN translated by J. T. Craddock, B COM, FIL, Ekard, Ray Park Avenue, Maidenhead, Berks. Maidenhead 24931.

WILFRED E. GOODAY, ARSM, DIC, MIMM, FIL. Member of Translators' Guild, Romanian and French. 161 Rivermead Court, London SW6. RENown 1912.

TECHNICAL TRANSLATIONS from Russian, German and Polish into English. B. Klipstein, B SC(HONS), 1 Glenview Grove, Shipley, Yorskhire. Tel. Shipley 58215.

TECHNICAL AND COMMERCIAL translations from English into Russian. Mrs O. Linsley, 31 Parke Road, Barnes, London SW13. Tel. 01-748 8822.

TRANSLATIONS FROM TURKISH. All subjects. F. P. Scott, 4 Uphill Grove, Mill Hill, London NW7.

RUSSIAN TO ENGLISH TRANSLATIONS. Physical sciences, all industries. Fast service. Ceramics and high temperatures specialities. Kenneth Shaw, c/o CIS Ltd, Churston End, Copythorne Road, Brixham, Devon. Tel. Brixham 3221.

TRANSLATIONS: TECHNICAL, SCIENTIFIC, all west-European languages. J. Smuts, B SC (ENGINEERING), FIL, 12 Thorndene Avenue, London N11. Tel. 01-360 7723.

TECHNICAL OR COMMERCIAL translations into/from English, German, Dutch and French. A. M. H. Speller, FIL, NGV, 6 Lakeside, West Ealing, London W13. Tel. 01-998 1045.

TECHNICAL TRANSLATIONS. Spanish French, German. Typescript, camera copy, direct image plates. E. W. Sykes, FIL, 39 West Close, Wembley Park, Middlesex. ARNold 4273.

COMPETENT commercial and technical translations from/into German and English. M. G. Young, FIL, 9 Osborne Road, Enfield. 01-804 4366.

Appointments vacant

INDEXING AND INFORMATION FOR THE CONSTRUCTION INDUSTRY. The Brixton School of Building and the School of Librarianship, North Western Polytechnic with the support of CIRIA (Construction Industry Research and Information Association) are jointly setting up a project to develop a basic classification and thesaurus of terms for use in the Construction Industry. A Research Fellow is needed for a period of two years (an Assistant Research Fellow will be appointed in the second year of the programme). Applications are invited from Librarians or Information Scientists with experience in the Construction Industry for work on the project at Brixton School of Building. The salary will be in the region of £2,100 to £2,300 according to experience and qualifications. Applications and inquiries should be addressed to K. G. Turner, Brixton School of Building, Ferndale Road, London SW4. (Tel. 01-274 0944, Extn. 32). (The closing date for applications is 18th October 1968).

THE ROYAL SOCIETY. ASSISTANT ARCHIVIST. Applications are invited for the post of assistant archivist to arrange and calendar the papers of a famous scientist. Archival experience essential, general knowledge of science desirable. Must be able to type own index cards. Five-day week, luncheon vouchers provided. Appointment will be for two years, salary offered £1,500 p.a. Applications with details of qualifications, experience and age by 4th October to The Executive Secretary, marked Assistant Archivist, The Royal Society, 6 Carlton House Terrace, London SW1.

THE ROYAL SOCIETY. LIBRARY ASSISTANT. Applications are invited for the post of Library Assistant for general library duties including cataloguing. Library training essential, general knowledge of science desirable. Must be able to type own index cards. Contributory pension scheme in operation, five-day week, luncheon vouchers provided. Salary £1,140–£2,160 p.a. Commencing salary according to qualifications, experience and age. Applications with details of qualifications, experience and age by 4th October to The Executive Secretary, marked Library Assistant, The Royal Society, 6 Carlton House Terrace, London SW1.

INFORMATION OFFICER required to develop a PRINTING TECHNOLOGY information service at Watford College of Technology. The work involves the expansion of existing library resources and information services to members of the college for study, teaching and research and to local industry within the HERTIS framework. The candidate should be familiar with the terminology and principles of graphic processes, experienced in handling technical or scientific information for industrial or academic enquirers and appropriately qualified. Salary within the range A.P. IV-V (£1,435–£1,865). Further details and application forms from the Registrar, Watford College of Technology, Hempstead Road, Watford, Herts.

INFORMATION SCIENTIST, GAS COUNCIL ENGINEERING RESEARCH STATION. Information scientists and recently graduated chemists or engineers interested in scientific information work are invited to apply for a vacancy within the Information Group of the Gas Council Engineering Research Station. The Group provides a library, information and printing service to staff working on R. & D. problems associated with the transmission and distribution of gas. The successful applicant will be responsible for scanning and abstracting scientific media received in the library, directing the information to relevant staff and for general enquiry work. Encouragement will be given to gain experience in all aspects of the Group's work. Excellent conditions of service are offered including pension and sick pay schemes. Starting salary will be within an incremental scale rising to £1,650 per annum with initial placing according to age, qualifications and previous experience. There are opportunities for advancement into more senior grades. Application forms may be obtained from: The Scientific Secretary, The Gas Council Engineering Research Station, Harvey Combe, Killingworth, Newcastle upon Tyne. NE12 0SB.

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ASLIB CALENDAR 1968

November

FRI. 1.	Course: Foreign language dictionaries.
TUE. 12.	Chemical Group/ECMRA joint conference.
TUE. 19.	Midlands Branch Meeting: Patents and standards in information work.
TUE. 19 – FRI. 22.	Course: Mechanization of housekeeping routines.
THU. 21.	Engineering Group Meeting: Microfiching of periodicals.
TUE. 26 – FRI. 29.	Course: Introduction to business records.
WED. 27 – THU. 28.	Course on work with patents. Birmingham.

December

TUE. 3 – FRI. 6.	Course: Systems analysis.
WED. 11.	Scottish Branch party.
MON. 16 – WED. 18.	Course: Literature of food and agriculture.
WED. 18.	Aslib Christmas Party.

1969

January

TUE. 14.	Aslib Midlands Branch, Birmingham.

February

TUE. 18.	Midlands Branch meeting: Cover-to-cover technical translations.

March

TUE. 25.	Midlands Branch annual general meeting. Birmingham.
FRI. 28.	Scottish Branch annual general meeting.

September

SUN. 21.	43rd Annual Conference, Coventry.

Membership Records

The Aslib Membership Department is carrying out a comprehensive check of its membership records as a preliminary to developing a more efficient system of record keeping which will, among other things, enable a list of Aslib members to be produced annually from 1969 onwards, and ensure that Branches and Groups can be supplied with up-to-date lists of their members at appropriate times. The system being developed will use the Vonamatic tape typewriter and the IBM 870 as a means of producing multiple records from a common input and may well be of interest to members with similar record-keeping problems.

To ensure that the records continue to be up-to-date, it is important that member organizations notify Aslib whenever changes occur. Please tell the Membership Department, preferably in writing, of changes in title, address, official representative, representatives of Groups, Branches, etc., as soon as you are aware of them. We should also be glad to know about any changes in the internal structure of a member organization's library and information services resulting from amalgamations, etc.

Aslib Courses on Mechanization

Two new courses in the series on mechanization will shortly be held at Aslib headquarters. These are on Mechanization of Housekeeping Routines, from 19th to 22nd November, and on Systems Analysis, which will run from 3rd to 6th December. Prospectuses and application forms for both courses are being distributed with this issue. Numbers on both courses will be strictly limited, so applications should be made early on the forms provided. Provisional bookings will be accepted by telephone or telex.

The Mechanized Housekeeping course is intended for senior staff of medium to large libraries which seriously contemplate mechanization of their housekeeping operations, and it will be assumed that participants have some knowledge of computers and standard peripheral equipment. The Systems Analysis course also will be of most value to those concerned with the organization and management of special libraries and information services. It will not, however, be solely concerned with systems involving computers or data processing equipment; mechanization will be treated as one of a number of features to be considered in the design of a library system.

Northern Aslib Bulletin

For a variety of reasons the production of *Northern Aslib Bulletin* in its old form has been suspended for some time. The Committee of the Northern Branch has decided that the future form of *NAB* will be that of a newsletter which will appear at irregular intervals.

The new bulletin will contain news of meetings, people and appointments together with reports of meetings held. There will be no reprints of papers in full, no editorial comments and no correspondence column.

Members' co-operation is sought in providing the news of changes in jobs, representation, addresses and any other information which may be of value to the members of the Branch. Information about meetings, conferences and courses which are of interest to members will also be welcomed.

Items for inclusion in the newsletter should be addressed to F. A. Graham, ALA, Group Librarian, Ferranti Ltd, Hollinwood, Lancashire.

REVIEWS

DANISH BIOTECHNICAL REVIEW. Biological and biotechnical activities and research projects at 104 public and private laboratories. 4th edition, edited by J. Korsbang. Copenhagen, Biocentralen: Danish Society of Biotechnical Industry and Research, 1968. 141 p.

This is the fourth biennial edition of a listing of Danish research institutes concerned with biology and biotechnology and is mainly in English.

Information on the 104 private and public laboratories includes the name of the body in both English and Danish, the address, details of activities and current and future research, together with names of staff and their qualifications. There are comprehensive indexes.

The publication is well produced, easy to use and should be of value to those in the biotechnical field.

PETERSEN, G. C. Who's who in New Zealand. 9th edition. Wellington, A. H. & A. W. Reed, 1968. 356 p. £3 6s (available in this country from Bailey Bros.).

The last edition of this work appeared in 1964. This new edition contains information on 3,000 prominent New Zealanders, including their date and place of birth, occupations and positions held, and recreations, as well as very brief details of their publications.

The supplementary information in the volume includes names of New Zealand Parliament members and voting details for the last two elections, heads of government departments and divisions, overseas representatives and those representing foreign countries in New Zealand, heads of the churches, and the names of people with honours. Information on New Zealand universities is also given, including the members of council, librarians and professors. There is a list of abbreviations.

VEREZICHNIS deutscher wissenschaftlicher Zeitschriften 1968 . . . im Auftrag der Deutschen Forschungsgemeinschaft, herausgegeben von der Deutschen Bibliothek, 7. Auflage. Wiesbaden, Franz Steiner Verlag, 1968. viii, 73 p.

This seventh edition includes a supplement covering new journals issued up to 30th November 1967. Arranged systematically, with a title index, it gives merely the title and publisher's name for each journal, but as a guide to the important German periodicals in each subject field it continues to be of value.

LIST OF SHORT COURSES IN LIBRARIANSHIP AND INFORMATION WORK

Dates	*Subject*	*Total no. of days*	*Location and cost*	*For whom intended*	*Organization and Collaborators*	*Name and address for inquiries*
Nov. 1	Foreign language dictionaries	1	London, 3 gns.	Library and information staff	Aslib	Education Officer, Aslib
Nov. 1	Information organisation and retrieval	1	Edinburgh, Napier College, £5	New entrants to scientific and technical libraries in Government, Industry or Education	Napier College of Science and Technology	J. L. Bate, MADipEd, FLA, Librarian, Napier College of Science and Technology, Colinton Road, Edinburgh, 10
Nov. 4–7	Introduction to Management for librarians	4	Medway and Maidstone College of Technology, Horsted, Chatham, Kent, 4 gns.	Practising librarians	Medway and Maidstone College of Technology and library authorities in area	P. O. Hart, Principal Lecturer Dept. of Management and Social Studies, Medway and Maidstone College of Technology, Horsted, Maidstone Road, Chatham, Kent
Nov. 15	Information organisation and retrieval	1	Edinburgh, Napier College, £5	New entrants to scientific and technical libraries in Government, Industry or Education	Napier College of Science and Technology	J. L. Bate, MADipEd, FLA, Librarian, Napier College of Science and Technology, Colinton Road, Edinburgh 10
Nov. 19–22	Mechanization of housekeeping routines	4	London, 18 gns.	Library and information staff	Aslib	Education Officer, Aslib

Nov. 25–29	Chemistry for chemical librarians	5	Harrogate £7 10s	Librarians and information officers concerned with chemical literature	Leeds College of Commerce	D. Daintree, FLA, Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
Nov. 26–29	Introduction to business records	4	London, 15 gns.	New staff in record departments	Aslib and Business Archive Council	Education Officer, Aslib
Nov. 27–28	Work with patents and elementary patent law	2	Birmingham, 8 gns.	Librarians and information officers	Aslib	Education Officer, Aslib
Dec. 3–6	Staff management in libraries	4	Leicester, *ca.* £16	Chief librarians and other senior staff from all types of libraries	North Midland Branch L.A.	D. Kennington, Chief Librarian, English Electric Co. Ltd., Whetstone, Leicester LE8 3LH
Dec. 3–6	Systems analysis	5	London, 20 gns.	Senior library and information staff	Aslib	Education Officer, Aslib
Dec. 16–20	Scientific literature and its guides	5	NLL, accommodation cost only	University academic staff	NLL	Dr K. P. Barr, NLL
Dec. 16–18	Literature of food and agriculture	3	London, 12 gns.	Librarians and information officers	Aslib	Education Officer, Aslib
1969 Jan. 1	Social Science Literature and its guides	5	NLL, accommodation cost only	Graduate research workers in the social sciences	NLL	Dr K. P. Barr, NLL
Feb. 10–14	Workshop on art librarianship	5	Harrogate, 10 gns.	Art librarians	Leeds College of Commerce	Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1

LIST OF SHORT COURSES—*continued*

Dates	*Subject*	*Total no. of days*	*Location and cost*	*For whom intended*	*Organization and collaborators*	*Name and address for inquiries*
Feb. 24–28	Workshop on electrical engineering librarianship	5	Harrogate, 10 gns.	Librarians working in the subject field	Leeds College of Commerce	Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
Mar. 10–14	Workshop on the literature and librarianship of agriculture and horticulture	5	Harrogate, 10 gns.	Librarians working in the subject field	Leeds College of Commerce	Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
Mar. 26–27	Co-ordinate indexing for information retrieval: a workshop and tutorial session	2	The Bell Inn, Aston Clinton (nr. Aylesbury), 20 gns.	Information officers		J. L. Jolley & Partners Ltd., Westbourne House, Westbourne Street, High Wycombe, Bucks.
April 14–18	Second workshop on law librarianship	5	Harrogate, 10 gns.	Law librarians	Leeds College of Commerce	Director of Short Courses, Dept. of Librarianship and Information Science, College of Commerce, 28 Park Place, Leeds 1
April 20–May 5	Medical bibliography for librarians	10	London, £95	Senior medical librarians from overseas	British Council	British Council, Courses Dept., 2/3 Bloomsbury Square, London WC1

April 21–25	Library techniques	5	Royal College of Nursing, London, 10½ gns.	Nurse tutors	Royal College of Nursing and National Council of Nurses' of the United Kingdom	The Librarian, Royal College of Nursing and National Council of Nurses of the United Kingdom, Henrietta Place, London W1
June 2–6	Management theme	5	Woburn College, £14 (provisional)	Senior academic, public and special librarians	London and Home Counties Branch of the LA	R. Brown, Esq., FLA, Public Library, Marylebone Road, London NW1
Sept. 19–21	School librarianship		Shrewsbury, Radbrook College of Education, N.D.	Teachers, librarians and others interested in school librarianship	School Library Association	R. Powell, Headmaster, Oswestry Boys' Modern School, Oswestry, Salop.

ELECTRONIC MATERIALS INFORMATION CENTRE

A. ROYLE

Paper presented at the Electronics Group annual conference, Saturday 22nd June 1968

THE production of electronic materials and the design and manufacture of electronic devices is now such a sophisticated industry that within it there exist three fairly distinct technologies, and scientists working in this industry tend to belong to one of the following three groups. First there are the materials scientists, who work on the preparation of single crystals, the formation of p–n junctions, the growth of epitaxial layers, the deposition of thin films. Secondly there are those who work on materials assessment, carrying out electrical measurements to determine carrier concentration, lifetime, etc., or using optical and electron microscopes, microprobe analysers and mass spectrometers to investigate the properties of electronic materials and to assess their device potential. Thirdly there are the device engineers, who design and manufacture a vast range of solid-state devices. These three groups are strongly interdependent and one simplified way of looking at the relationships between them is to consider the materials scientists as producers, the device engineers as consumers, with the materials assessment group acting as a consumer association. Within this system the EMIC seeks to act as an intermediary and to connect the demand to the supply, but not to act as a retailer.

In the larger firms and establishments there is often an integrated division which contains people from each of these three groups. The work they are doing will differ in that certain divisions will be working on different materials, or different groups of materials—say semiconductors, optical materials or ferroelectric materials; on the other hand, they may be concentrating on making different devices from the same material, e.g. microcircuits for computers or thyristors from silicon. Where there are big integrated divisions, the EMIC will try to facilitate an exchange of materials, information or services. Many of the smaller firms, however, have only device engineers and must buy their crystals and assessment services elsewhere. It is these smaller firms and university research groups which will find the EMIC particularly useful.

Electronic materials are difficult to make. The processes involved are time consuming and costly. Hence there is a general shortage of material. Furthermore, many of the interesting new materials are made only by research groups who want most of the material for their own use; they are not anxious to sell and therefore do not advertise. Electronic materials are very pure substances to which minute amounts of specific impurities are added to give them certain electrical properties. The control of impurities is particularly important, as the characteristics of any device are dependent on the presence or absence of specific impurities and in some cases also on the method of preparation.

This general shortage of device material and the excessively stringent control of material purity gives rise to two supply problems, one of which concerns the crystal grower and one of which concerns the device engineer. The crystal growers require starting materials of a purity higher than the standard analytical reagent grade; therefore they must find a specialist producer of high-purity elements and compounds or purify the material themselves. They must also find suppliers of high-purity acids, high-purity quartz crucibles and refractory materials from which to build their crystal pullers. The EMIC tries to help the crystal growers with this problem by keeping lists of specialist suppliers of high-purity materials and crystal-growing equipment and details of methods of purification and analytical facilities. The EMIC also keeps lists of desired materials and will inform crystal growers of the demand. Whenever a new material with some interesting property is synthesized there are always people anxious to use it. Creating a supply invariably creates a demand.

The device engineer wants to know where he can buy good crystals, i.e. good device material, but finding a supplier is difficult for the reasons given above and also because it is difficult to define completely the constitution of good device material. The drawing up of a specification for an electronic material is a difficult and complicated task. In the manufacture of devices and microcircuits there is a high percentage of failures—in some cases only 20 per cent of the devices produced have the desired characteristics. The reasons for this failure are being investigated thoroughly; in some cases the failure is due to faulty fabrication, and in others it is due to crystallographic defects. Development is continually taking place as the assessment group find new and more refined techniques for identifying the reasons for device failure, which in turn modify the fabrication processes and the specifications of device material, and also, of course, as understanding of the fundamental processes involved increases. It is important that the EMIC should appreciate this development and be at a centre where this technical expertise is available, so that it can advise its clients on the detailed specification of device material; the centre should not only be able to answer questions posed by its clients but should also be able to help them formulate the most relevant questions on device specification.

As I pointed out previously, there is a general shortage of good device material; there is always a demand for new materials and for materials as good as those being produced in the research laboratories. It was to satisfy this demand that the Electronic Materials Unit was set up. The Royal Radar Establishment, Malvern, is a good centre at which to set up such a unit because, although research on electronic materials is being carried out at other Government establishments and in industrial laboratories, there is a concentration of effort at RRE and its Electronic Materials and Solid State Device Research divisions have reputations as 'centres of excellence'. The Electronic Materials Unit is demand-orientated and is selling under commercial conditions developed and partially developed materials.

This then is a statement of the problem which the EMIC is trying to alleviate. The centre is collecting and disseminating information on the availability of research specimens, special materials, techniques of crystal growth, methods of purification, and analytical facilities. For the moment the effort that is available is limited and this effort is focused on the materials supply problem; however, it is possible that it will enter the literature field at some later date.

With this limited effort it is necessary to evolve a simple and effective method of processing the information. The materials of interest can be classified under the following headings:

1 Chemical formula
2 Physical properties
3 Crystalline structure
4 Applications
5 Method of production.

To keep our initial system simple we had to choose only one of these headings and we chose the chemical formula. This classification was chosen because most of the requests received by the centre are of the form 'where can I buy *x* grams of single crystal of germanium or calcium tungstate?' Furthermore, by the time a research scientist or a designer has decided on his material specification he is usually able to state its chemical formula. When this is not the case and we receive such unusual inquiries as, 'Is it possible to have a semiconductor with such and such properties and if so what is this material?' we are able to consult the physicists in the research divisions and usually with their help we are able to provide an answer.

Using this single classification system, the collection and dissemination of information is carried out in the following way. Data sheets similar in form and layout to the ones used by the Oak Ridge Research Materials Information Centre are sent out to all known crystal growers, suppliers of high-purity metals, acids, etc. Those of them who are willing to supply information on their materials and to supply specimens either in commercial or research quantities then complete and return these data sheets. The data sheets are filed under the chemical formula heading. At present there are approximately 1,000 sheets covering about 400 materials. Anyone making a request for information on suppliers of a given material is sent photocopies of all relevant data sheets. The form of the data sheets was made similar to the Oak Ridge one so that an exchange of information between us and them would be quite simple. In fact, we have a reciprocal arrangement with the Oak Ridge Centre by which each centre can pass on to the other inquiries which it is unable to answer; both centres have benefited from this arrangement. As the chemical formula for some of the materials is not at all obvious from the name (for example, pronstite has the formula $AgAsS$), we have an alphabetical list of names of materials and their chemical formulae. This list certainly helps the clerical staff who answer some of the straightforward inquiries. A list of materials will be periodically circulated to all those who have contributed to our collection of data and to all probable users of electronic materials.

We propose to expand and refine this system, keeping in mind the following points. The functions of the centre are to collect and disseminate information on electronic materials (and later on the system may include literature as well as suppliers) and to store this information so that it is easily accessible and easily revised. Whatever system we choose we must appreciate that the indexing and input of information must be carried out by materials scientists/information scientists, but the information retrieval and the answering of simple queries should be carried out by clerical or junior scientific staff. Any indexing system should be able to accommodate a large increase in the number of new materials as well as increase in the properties and methods of production.

The present system is in fact to be extended to a Keydex system, and we are also investigating the possibility of using the new 'natural' language which is being developed at RRE for information retrieval on RREAC (the RRE computer). This language is called CLIC (Command Language for Interrogating the Computer).

FURTHER COMMENTS ON THE TERMINOLOGY OF THE ANALYSIS OF LIBRARY SYSTEMS

ALAN GILCHRIST

Aslib Research Department

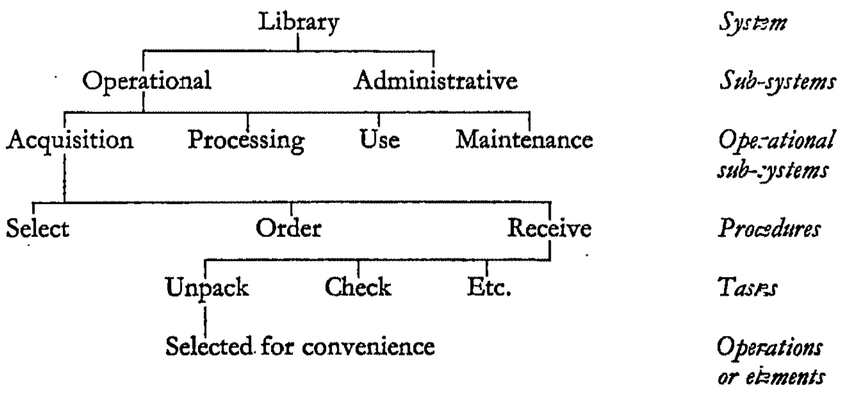
IN a recent issue of this journal Thomas and East[1] outlined the difficulties in communication which faced the Aslib Research Department arising from increased attention to the use of management techniques in library/information systems. Their project, involving a study of the use of bibliographic records in libraries, led to a need to define certain terms relating to systems and their analysis, and this paper attempts to continue the same line of thought. It should be reiterated here that the two papers do not attempt to provide the standard terminology but a standard terminology for a group of co-workers.

The need to extend the framework of definitions has arisen from another project of the Aslib Research Department titled 'Economics of Library Processes'.[2, 3] The aim of this project is to systematically study a wide range of processes, and to evaluate the economics of alternative techniques. This will involve the use of a number of management techniques whose applicability will be concurrently assessed.

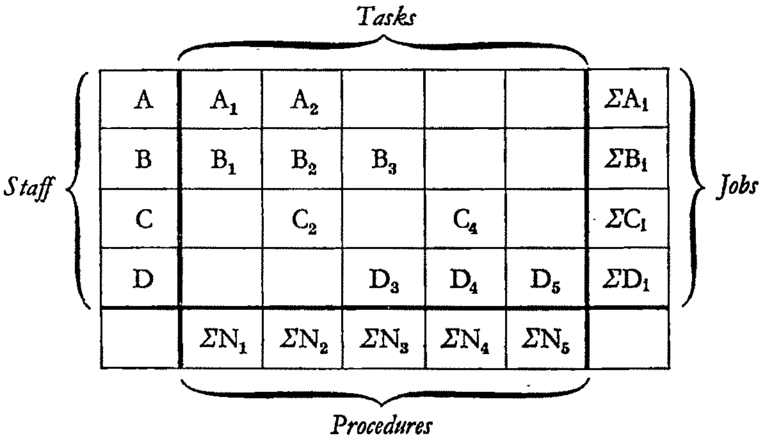
The Institute of Office Management has suggested four definitions for different operational cross-sections:

Task: a related group of clerical operations carried out on a particular kind of information.
Job: a series of tasks, usually related, grouped together to form a work load for a clerk.
Procedure: a series of related jobs carried out by several clerks.
System: a series of related procedures by means of which a major (business) activity is carried on.

These definitions are applied to an office, but of course a library is a specialized office, having the same broad functions as were noted by Thomas and East.[1] In terms of these definitions the library system can be seen hierarchically as:



Jobs cut across this hierarchy, and can be depicted in a simplified matrix where each square represents a task:


Tasks
Staff
Jobs
Procedures

A	A_1	A_2				ΣA_i
B	B_1	B_2	B_3			ΣB_i
C		C_2		C_4		ΣC_i
D			D_3	D_4	D_5	ΣD_i
	ΣN_1	ΣN_2	ΣN_3	ΣN_4	ΣN_5	

So far, the library has been defined as a system with generalized functions, but no specific purpose. As all libraries are designed for known or unknown populations of users, we may call this higher level of system plus users a service. This distinction between system and service will help to clarify the difference between efficiency and effectiveness, terms which have been defined by Drucker as:

Efficiency: doing anything (right or wrong) in a less wasteful manner.
Effectiveness: doing the right thing to achieve your objects.

This has been restated by Rees,[4] who claims that there are two sets of criteria needed for evaluation:

'1. to provide a measure of the effectiveness or the extent to which a library is fulfilling its purpose.
and 2. to measure efficiency or the cost and time expended in achieving the stated purpose.'

Herner[5] has expanded this theme in his statement that 'In order to evaluate a system, we have to find answers to five basic questions:

1. what services should the system be performing on behalf of its users?
2. is the system performing all the services it should be performing?
3. is the system performing any services that it should not be performing?
4. is it performing the services it should be performing as efficiently and economically as possible?
5. if not, what are the causes, and what can be done to remedy the problem or problems?'

Thus, effectiveness is measured in terms of goal achievement, and efficiency in terms of cost and time. For example, the Cranfield experiments compared the effectiveness but not the efficiency of indexing systems, though this deficiency was well appreciated.[6] The problem of comparing efficiency rested in the gathering of data covering enough of the multiplicity of possible physical vehicles that each indexing system could employ. This example also indicates that it is usual to be concerned with the effectiveness of a 'service-system' and the efficiency of its parts, where Cranfield was concerned with a library sub-system. It can be argued that each level has its goals and therefore that effectiveness can be considered at any level, but in fact at the procedural level effectiveness is largely self-checking.

Now we can look at some management techniques in relation to the system structure and system evaluation. At the service level, and outside the scope of this paper, are techniques such as Market Research, User Surveys, Cost-Effectiveness Analysis, Cost Benefit Analysis and methods of measurement of effectiveness and user satisfaction. At the system level and lower there is a tangle of Anglo-American terminology consisting of homonymous terms and overlapping concepts. Systems Analysis and Organization and Methods can be considered generically as titles of service departments employing collections of techniques relevant to a particular organization. However, it is possible to use these terms more specifically in relation to the structure. System Analysis and its creative adjunct System Design are here confined to the system level, but not, as is increasingly common, confined to the analysis and subsequent design of computerized systems. As Becker[7] says, 'System Analysis looks at the larger problem rather than at the narrower implications of the particular task at hand'. And of System Design, Hayes[8] says, 'it is probably the crucial concept in the theory and application of "information science" . . . it is an approach, a process, a philosophy . . . it uses the model, rather than "similar" existing real situations, to help determine what a desired system should be.' By our definition System Analysis confines itself to the system as it is operating, whereas System Design must consider the system (to be changed or originated) as a service. This principle is of course true at the lower levels where, for example, the O & M practitioner must be fully aware of the system requirements. (Some would subsume all lower level techniques under the heading Systems Analysis. In the USA 'Systems and Procedures' includes System Analysis, System Design, Method Study and Work Simplification. Certainly, the two areas are complementary.)

The remaining levels come within the range of the O & M Service, which is defined as 'a service giving advice on the structure of an organization, its management and control, and its procedure and methods'.[9] This service is concerned with Organization (in the USA Organizational Analysis—part of Systems and Procedures), Work Study, Forms Design, Office Machinery and Job Analysis as its chief areas of interest. The two major techniques under the heading Work Study are:

Method Study: the systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective* methods and reducing costs.

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* This author would prefer the word efficient in this context.

Work Measurement: the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance.[10]

Method Study, aided by a battery of formalized charts, diagrams and notes, is applied at the procedural and job levels. Work Measurement, which evolved in the factory environment at the most detailed level, is becoming increasingly useful in the office. It uses the two techniques Time Study, which basically is used for the determination of time standards, and Motion Study, which uses such devices as Therblig charts and was primarily designed for the improvement of methods. These two combine in another Work Measurement technique called in this country PMTS (Predetermined motion time system) whereby times established for basic human motions are used to build up the time for an operation at a defined level of performance. There are a number of other similar systems including MTM (Methods-Time Measurement) and the Work-Factor System. Whereas PMTS is used for synthesis, Activity Sampling (known in the USA as Work Sampling) is an analytical technique, using random observations of a group of processes or workers in order to establish the percentage times taken up by different activities. By extension it can be used to determine rough time standards. In addition to these techniques the O & M practitioner should have some knowledge of ergonomics.

There remain those techniques that are pervasive to the whole structure and not confined to levels. The first of these is Costing, which is defined as 'the techniques and processes of ascertaining the amount of expenditure (actual or notional) incurred on or attributable to particular products, processes or services'.[9] There are a number of types of Costing which could profitably be applied to the library situation, including Standard Costing and Marginal Costing. In the personnel area, Job Analysis has already been mentioned as an O & M technique and stemming from this come Job Description and Job Grading, which are of use in staffing, training and salary structuring. All the above techniques can be employed by any library by the Administrative half of the structure, the Administrative Sub-systems devoted to Accountancy, Personnel, Planning, Control, etc.

Last, but in no way least, comes Operations Research. A great deal has been written on this subject and there are many definitions: the one presented here is fuller than most:[11]

> OR is the science that is devoted to describing, understanding, and predicting the behaviour of man-machine systems. Thus, OR workers are engaged in three classical aspects of science.
>
> 1 describing the behaviour of the systems.
> 2. analysing the behaviour by constructing theories (frequently called models) that account for the observed phenomena.
> 3. using these theories to predict future behaviour, that is, the effects that will be produced by changes in the systems or in their methods of operation.

Operations Research is a multi-disciplinary science, mainly mathematical, employing several computer-aided techniques, of which Model Building is probably the most fundamental to the discipline. Other OR techniques of immediate interest to libraries include Linear Programming, Queuing Theory and Simulation.

This is a rough framework of the structure of the library system and the most relevant management techniques. The particular project, mentioned earlier, will work mainly with O & M techniques, but other projects and consultancies will cover a far wider area. It must be remembered that this framework is a guide only: the cross-country hiker uses a map to show himself where he is in relation to the roads, and we shall soon find ourselves working between levels, mixing techniques, and adapting them to our own needs. Natural constraints and human considerations will force compromises and we shall have to remember that experience and flexibility are important attributes in the application of these techniques. The main function of the practitioner of Systems Analysis or Organization and Methods is to initiate change. It is a truism to say that people resist change, but this resistance is a fact of life, which in itself is neither good nor bad. The other two entities with which the practitioner works are machinery/equipment, which is subject to constant development; and procedures/systems, which can be regarded as the interaction between people and machines. The optimum design or solution to a problem is, therefore, not the one which is the most efficient but the one that is the most effective. In other words, it is the solution which strikes the best balance between theory and acceptance by the operators of the system.

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Letter to the Editor

THESAURUS COMPILATION METHODS

Dear Sir,

Mr Blagden has presented a very interesting and concise account of the problems of thesaurus compilation (*Aslib Proc.,* vol. 20, no. 8, August 1968), and his final conclusions are entirely in line with the experimental evidence. However, recent experimental work[1] has shown that in a given situation (i.e. a particular set of documents and search questions), there was an optimum of index exhaustivity (i.e. the number of terms assigned to each document) and index language specificity (i.e. the number of distinct terms, and the precision devices, such as roles and links, which are used). It was also shown that there is a very close inter-relationship between the level of indexing exhaustivity and the specificity of index language.

Assume, for instance, a system which had been operating satisfactorily when an average of eight terms had been used for indexing each document. If the decision was taken to increase the level to twenty terms per document, then it would be probably found necessary to make a corresponding adjustment in the specificity of the index lanauge, either by the inclusion of additional terms or by the use of precision devices. Unfortunately, as Mr Blagden has found, there can be no formal rules laid down for thesaurus construction, because the index language is only a minor sub-system of the complete system. As such, it will be strongly affected by the other sub-systems, and performance will be found to be dependent on the document collection, the indexing decisions, the search strategies and the user requirements.

The importance of considering an information retrieval system as a whole and not as separate parts is clearly shown in the report by Lancaster on the evaluation of the MEDLARS system in Washington.[2]

Yours faithfully,
CYRIL CLEVERDON

College of Aeronautics Library,
Cranfield, Bedford.
6th September 1968.

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MEMBERS' ADVERTISEMENTS

Acceptance of advertisements for publication in Proceedings *does not imply Aslib support for or endorsement of the goods or services advertised.*

The charge for advertisements in these columns is 4*d* per word, minimum 5*s*. An additional charge of 6*d* is made for the use of a box number.

AUTHORITATIVE TECHNICAL TRANSLATIONS from French, German, and Dutch into English and from English, French and German into Dutch, specialities electronics, optics, instruments, photography. API Ltd, director K. S. Ankersmit, FIL (French, German, English), 19 Godstone Road, Purley, Surrey. BYWood 3781.

TECHNICAL SWEDISH, DANISH, NORWEGIAN translated by J. T. Craddock, B COM, FIL, Ekard, Ray Park Avenue, Maidenhead, Berks. Maidenhead 24931.

WILFRED E. GOODAY, ARSM, DIC, MIMM, FIL. Member of Translators' Guild, Romanian and French. 161 Rivermead Court, London SW6. RENown 1912.

MEDICAL, PHARMACEUTICAL, BIOLOGICAL translations from French, Rumanian and Portuguese into English and from English into French and Rumanian. Dr J. Jacobson, 94 Temple Fortune Lane, NW11. 01-455 1010.

TECHNICAL TRANSLATIONS from Russian, German and Polish into English. B. Klipstein, B SC(HONS), 1 Glenview Grove, Shipley, Yorkshire. Tel. Shipley 58215.

TECHNICAL AND COMMERCIAL translations from English into Russian. Mrs O. Linsley, 31 Parke Road, Barnes, London SW13. Tel. 01-748 8822.

TRANSLATIONS FROM TURKISH. All subjects. F. P. Scott, 4 Uphill Grove, Mill Hill, London NW7.

RUSSIAN TO ENGLISH TRANSLATIONS. Physical sciences, all industries. Fast service. Ceramics and high temperatures specialities. Kenneth Shaw, c/o CIS Ltd, Churston End, Copythorne Road, Brixham, Devon. Tel. Brixham 3221.

TRANSLATIONS: TECHNICAL, SCIENTIFIC, all west-European languages. J. Smuts, B SC (ENGINEERING), FIL, 12 Thorndene Avenue, London N11. Tel. 01-360 7723.

TECHNICAL OR COMMERCIAL translations into/from English, German, Dutch and French. A. M. H. Speller, FIL, NGV, 6 Lakeside, West Ealing, London W13. Tel. 01-998 1045.

TECHNICAL TRANSLATIONS. Spanish French, German. Typescript, camera copy, direct image plates. E. W. Sykes, FIL, 39 West Close, Wembley Park, Middlesex. ARNold 4273.

COMPETENT commercial and technical translations from/into German and English. M. G. Young, FIL, 9 Osborne Road, Enfield. 01-804 4366.

Appointments vacant

BBC requires CHARTERED LIBRARIAN to take charge of a technical library at its Research Department at Kingswood Warren, Surrey. The Department carries out work in all aspects of Radio and Television broadcasting engineering and the librarian will be required to assist staff to keep abreast of technical publications and books and help them to locate information. He should therefore have had previous experience in a technical library and knowledge of the subject field in question. Salary £1,400 (may be higher if qualifications exceptional) × £75 to £1,775. Requests for application forms (enclosing addressed envelope and quoting reference 68.G.323) must reach Appointments Department, BBC, PO Box 1AA, London W1, by Monday, 4th November 1968.

INFORMATION OFFICER: A new vacancy has occurred for an Information Officer at the General Secretariat of the International Federation for Documentation in The Hague. Applicants should have documentation or library training, and be fluent in English and either French or Spanish. Duties will involve literature searches, the compiling of news features for the *FID News Bulletin*, etc. Gross monthly salary: 1,100 Dutch guilders, subject to local taxes. The vacancy is to be filled on 1st January 1969. Applications should reach the General Secretariat, FID, 7 Hofweg, The Hague, Netherlands, by 22nd November 1968.

ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 November 1968 Number 11

ASLIB CALENDAR 1968

CALCUTTA UNIVERSITY CENTRAL LIBRARY

December	
UE.3 – FRI.6.	Course: Systems analysis.
ED.11.	Scottish Branch party.
ON.16 – WED.18.	Course: Literature of food and agriculture.
ED.18.	Aslib Christmas Party.
	1969
January	
TUE.14.	Aslib Midlands Branch, Birmingham.
February	
ED.12.	Scottish Branch meeting. Speaker: Mr L. J. Anthony, Assistant Director (Services), Aslib.
UE.18.	Midlands Branch meeting: Cover-to-cover technical translations.
March	
UE.25.	Midlands Branch annual general meeting. Birmingham.
FRI.28.	Scottish Branch annual general meeting.
May	
THU.15.	Engineering Group Conference on Government Supported Information Centres. Birmingham.
tember	
JN.21.	43rd Annual Conference, Coventry.

New business techniques for library management

A two-day seminar for senior librarians, sponsored by the University of Bradford, the Library Association and Aslib, will be held at the Management Centre, University of Bradford, on the 19th and 20th February 1969.

Its object is to introduce new concepts and techniques developed in the business world, and to examine their relevance to library management.

The course fee is 35 gns. Further details may be obtained from David Ashton, Assistant Director of Post-Experience Programmes, Management Centre, University of Bradford, Emm Lane, Bradford 9.

Delays in receipt of overseas journals

One or two members have recently complained of excessive delays in the receipt of journals from overseas, particularly from the USA, and instances have been quoted of issues arriving up to three months after publication date. If these delays are fairly common in the experience of members Aslib is willing to take up the matter with the overseas publishers concerned, and the Director would welcome specific information on which any such approaches could be based. Letters giving the title, issue date and date of receipt should be addressed to the Director, together with any comments which members may feel shed any light on the stage or stages at which the delays have occurred.

Members' Christmas Party

Members are invited to Aslib Headquarters on Wednesday 18th December 1968 from 5.30 to 7.30 p.m. to the annual Christmas party.

Drinks, both alcoholic and soft, and snacks will be served by the staff.

Admission will be by ticket only, price 12*s* 6*d* per person. Applications should reach Aslib not later than Monday 2nd December 1968.

Joint Aslib/CEI Conference

A conference on 'Technical Information for Engineers', sponsored jointly by Aslib and the Council of Engineering Institutions, was held at the Institution of Mechanical Engineers on the 10th October. About 250 attended, of which over one hundred were engineers, and the remainder mainly information officers and technical librarians. The participation of so many engineers—a great improvement over previous conferences of this kind—was regarded with satisfaction by the organizers, although it gave rise to problems of compatibility in the presentation and content of papers.

After the opening address by Sir Leonard Drucquer, Chairman of CEI, the morning was devoted to an exposition of what information services can provide for engineers. Mr C. W. Hanson gave an introductory paper, reviewing basic information sources for engineers. Five information experts then provided brief accounts of how they had answered specific inquiries. The latter ranged in subject area from metal forming techniques to the identification of cattle, and illustrated well the effectiveness of good information services.

In the afternoon four papers on the general theme of 'Engineers' needs for information', showing an interesting diversity of viewpoints, were presented by Mr B. T. Turner of English Electric, Dr J. H. Chesters of United Steel Companies, Dr D. S. Oliver of Pilkington Brothers, and Mr E. P. Peregrine, a consulting engineer. The closing address was by Sir Frederick Warner.

Current awareness needs of physicists

The results of an Anglo-American study on the current awareness needs of physicists are now available in the form of three reports. The study, which was conducted by the Aslib Research Department (acting for the Institution of Electrical Engineers) and the American Institute of Physics, took place in 1966, the first year of publication of *Current Papers in Physics.* Its aims were to assess the need for and reactions to this new current awareness journal, and to obtain background information on the current awareness requirements of the physics community.

The three reports are:

SLATER, M., *and* KEENAN, S. Results of questionnaire on current awareness methods used by physicists prior to the publication of *Current Papers in Physics.* London, IEE, (INSPEC 1); New York, AIP, (AIP/CPP 1), 1967.

SLATER, M., *and* KEENAN, S. *Current Papers in Physics* user study: coverage, arrangement and format. (INSPEC 2) (AIP/CPP 2), 1968.

SLATER, M., *and* KEENAN, S. Use made of *Current Papers in Physics.* (INSPEC 3) (AIP/CPP 3), 1968.

These reports are available free of charge from the Aslib Research Department.

Project LOC

The Old Dominion Foundation, of New York, has made a grant of $55,000 to the Bodleian Library at Oxford, the University Library at Cambridge and the British Museum, so that they may carry out together some experiments in the collection of cataloguing information and its handling by computer. These experiments are to be a pilot project for a union catalogue of early books (up to 1801) in all languages in the British Museum and in the college and university libraries at Oxford and Cambridge. The experiments, called collectively Project LOC, are expected to take a year. The Project will be administered and controlled by representatives of the three institutions and will be under the direction of Mr J. W. Jolliffe of the British Museum. The processing of the information will be carried out on the Titan computer at Cambridge.

Seminar on UDC in a Mechanized Retrieval System

Sixty participants from fourteen countries attended the Seminar on UDC in a Mechanized Retrieval System, which was held in Copenhagen from 2nd to 6th September. The Seminar was held under the auspices of FID, and hospitably organized by the Danish Centre for Documentation. It owed its origin, however, to Mrs P. Atherton and Mr R. Freeman, who had advocated such a meeting at the conclusion of their work on the American Institute of Physics UDC Project. The work undertaken in the course of the Project has been well documented* but it was anticipated that there would be many requests from potential users for instruction on how to operate the systems that had been developed. The Seminar was organized largely with a view to meeting this need for practical instruction, and proved to be highly effective.

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* Reports Numbers AIP/UDC 1 to 9, available either from the Information Division, American Institute of Physics, or from the Clearing House for Federal Scientific and Technical Information.

A detailed description was given of the IBM Combined File Search System as used in the Project, and the processes of entering data into the system and of addressing inquiries to it were demonstrated. All participants were taken step-by-step through the processes of encoding literature references and UDC numbers for input to the system, and the examples that they prepared were later key-punched and printed out on an IBM 1401 computer at the Northern European University Computer Centre. They were later shown how to prepare search questions for input, and were able to visit the computer centre where their requests were processed. The resulting answers, when printed out, provided a useful basis for discussion on search strategy in a UDC-based system.

Lectures were given on the AUDACIOUS experiment with an on-line interactive retrieval system, which also formed part of the AIP/UDC Project, but no demonstrations could be given of this as the necessary equipment was not available.

Several other papers were presented on current or intended uses of UDC in mechanized systems in Denmark, Germany, the UK and USA, and the present state of development and availability of the UDC schedules was reviewed. It is intended to publish an account of the Seminar in due course.

NRLSI Bayswater Division

On Tuesday 29th October the recently formed Bayswater Division of the National Reference Library of Science and Invention opened for direct use by the public.

The Bayswater Division is at 10 Porchester Gardens, Queensway, London W2, a short walk only from the Bayswater or Queensway underground stations. It will be open from 10 a.m. to 4 p.m. Monday to Friday.

Because of the limitations of the Division's temporary quarters, only abstracts journals, reference works and dictionaries are on open access, but readers will receive other volumes from the stack within a few minutes. The Bayswater Division already contains over nine thousand different periodicals and seventeen thousand books, and a scientifically qualified staff is available to help users exploit them.

Between them, the Bayswater and Holborn Divisions cover the whole range of the natural sciences and technology. The stock of the Bayswater Division is particularly rich in modern literature of the life sciences, of physical sciences not normally associated with invention (e.g. geology, astronomy) and in publications from Eastern Europe and the Orient. As at the Holborn Division, equal emphasis has been placed upon acquiring scientific and technological literature. Student textbooks and literature on the history or philosophy of science are, in general, not taken.

41st ASLIB ANNUAL CONFERENCE, CANTERBURY 1968

PRESIDENTIAL ADDRESS

SIR REGINALD VERDON-SMITH

I should like to talk for a short while about one or two features of the industrial background against which the hopes and aspirations of specialist activities such as yours, or at any rate many of you, have to be judged and measured, judged in the context of the private opportunity for achievement, and of the public benefit, and measured by reference to their scale, their availability and their cost.

It is always a good thing to look from time to time at the relevance which one's work has in the wider context of the world around us and the appeal it makes to those whom we think should be our customers. Sometimes this is a bit discouraging, sometimes quite the reverse—but at least it helps to identify opportunities which might not otherwise catch the eye of the dedicated and concentrated specialist.

In the case of the work of Aslib's members it seems to me, that even after the Association's forty-two years of life and development, you are only at the threshold of your growth and importance as a profession—and it is for this reason that the emphasis placed at this Conference on your educational programme is so timely and so interesting. It is especially satisfactory as it seems to me that the Sheffield Report should stress the need, in a bachelor degree course, of a central unifying discipline, and one which has a clear relevance to the contemporary environment. Perhaps in the fullness of time other university courses on more traditional subjects will follow suit.

It is a commonplace that in our lifetime scientific knowledge has been growing at an ever faster rate year by year and that it is penetrating ever more deeply into the fundamentals of nature and of life itself. This growth of scientific knowledge—originally your principal raw material—has itself created immense problems of recording, analysis and communication, which threaten to swamp all the libraries of the world. The technical solution of these problems is of course the primary function of most of you present at this Conference and takes me far out of my depth.

But if the proliferation of scientific knowledge demands your attention, the advances of technology—the application of all this new scientific knowledge—are even more compelling, for technology deliberately strives in a thousand ways to transform every aspect of human relations and promises to open new worlds—both metaphorically and even literally—and yours is the role not only of helping to quarry and distribute the raw material of scientific knowledge but more and more of assisting the technological processes by which industry makes this mass of knowledge useful in the service of mankind—and does so economically, that is without excessive duplication in the absorption of resources.

Someone will perhaps say that this sounds all very fine but does not ring true in relation to many sectors of industry which have been depressingly slow to appreciate the significance of your services. This of course is always the experience of those who are breaking new ground. I was both touched and amused by the *cri du coeur* in Professor Allen's paper when he wrote:

> 'The engineers just do not read—when we look at the amount of contact between the average engineer and his technical literature the situation is somewhat distressing'.

It was indeed very much because my own empirical and *ad hoc* impressions on this subject several years ago were just the same as those of Professor Allen that when Sir Norman Kipping, then Director-General of the Federation of British Industries, encouraged me to accept an invitation to become a Vice-President of Aslib I did so—hoping that in a small way I could lend a hand from the industrial side in a necessary bridge-building process.

It was also at about that time that I had a variety of experiences of sheer ignorance and indifference to existing technology—in this case in the design of aircraft—cases where competent above-average engineers had manifestly failed to read their technical literature, and I remember suggesting—light-heartedly but with feeling—that an annual lecture should be arranged by the Royal Aeronautical Society to be given by a distinguished senior engineer on the theme 'Don't invent what already exists—don't ignore existing knowledge—almost everything has been attempted before', but my engineering friends thought the proposal in very poor taste, and merely demonstrated to them that I just didn't understand the true nature of the pragmatist's approach towards a perfect engineering solution.

All the same, I notice that examples constantly accrue—not least because modern projects have to spread over so long a period of time that the man who designed some particular component on the last occasion has long since retired or died and his knowledge has perished with him.

And if this is true in one firm and in one country, you may depend upon it that international collaboration on complex engineering projects, such as supersonic aircraft, will provide a new collection of illustrations of ignorance which will certainly have to be published to the world one day as a warning to others.

But to return to my theme—I suggested just now that it is well from time to time to measure one's activities against the wider background of their application. The background which I have in mind is primarily industry and government—and the national and international setting in which the government and industry of Britain operates in the industrial society of the 1960s. How are the companies and organizations whom you expect to serve shaping up?

If one judges the nation's progress by studying Public Reports—Royal Commissions, departmental committees and so on—one really forms a pretty depressing picture of the progress to date of the 'technological revolution' upon which an improvement in our fortunes is popularly expected to depend.

For example, in the field of *scientific manpower,* we have been witnessing among the young the swing away from science in the schools—a subject studied by the Dainton Committee; we have been faced by the Jones Committee with the facts and figures of the brain drain, and now Professor Swann's Committee is about to come out with a report on the flow into employment of scientists, engineers and technologists which will point to many other difficulties in the recruitment of scientists for productive industry. All these in their various ways demonstrate that the rate and direction of technological progress depend on many human and social problems, individual and communal, which cannot be determined merely by political declarations of policy, or even by economic inducements. Environment, parental and educational influences, attitudes towards discipline and constraint, all play their part and it is plain that we have not achieved the optimum distribution of talent in different sectors of the community or indeed have any clear idea what the optimum should be.

Again in the field of *industrial relations* it is hard to regard the state of progress with anything but dismay. Again and again situations develop in factories, in offices and in the public services which seem totally absurd—every week provides a new example—and the recent report of the Donovan Commission demonstrates only too clearly how deep-rooted is the reluctance of the Trade Union movement—perhaps even of the country generally—to face up to the need for a completely different attitude to work, and especially towards industrial conflict, if technological change is ever to be allowed to come to the rescue of our economic weaknesses.

As for the *economic situation* itself—the product of so many separate factors—we are regularly bombarded by successive bulletins from the National Institute, warnings from the Bank of England and jabs by the Prices and Incomes Board—all more or less critical both about the economic performance of Britain since World War II and about our prospects for the future in the absence of a real change of attitude.

One has an uncomfortable awareness that the evidence on which these Reports are based is inescapable, and, sad to say, this is by no means the whole catalogue. Study of yet another recent report—the Fulton Report on the Civil Service—adds the need for parallel changes in the Government service every bit as far-reaching as those required in industry.

If such criticisms are going to remain valid in the years ahead it is hardly an encouraging prospect for a group of people such as the members of Aslib, who might be said to be concerned more than most with the much-heralded progress of the technological revolution and to be looking to it for widespread recognition of the value and the advantages of your services.

But for my part I do *not* think it is facile optimism to claim that where technological progress in industry is concerned these criticisms already belong to quite a large extent to the past. There are many signs that we are now at last beginning to benefit from two vitally important changes in the industrial environment—changes in the structure of industry, and changes in the quality and performance of management—both of them of great interest and importance to Aslib because both make increased demands upon your services.

Industrial change comes slowly: its origins in any single company are largely a matter of chance, it faces inevitable resistance, and, because it so easily creates individual hardship—or at least the fear of it—it is unwelcome and difficult to bring about. Politicians have of course popularized the general notion of technological change as though revolutionary results are the work of a year or two—as though, for example, Neddy and all the little Neddys could bring next year's balance of payments out of the red and into the black by some miraculous transformation in our international trade. In fact, we need at least a generation of concentrated attention to new methods before we can expect to achieve a real revolution in the habits of a century and more of the craft-based industries, such as engineering, upon which we so largely depend for our export trade.

But what I find encouraging—and it is almost a paradox to call it encouraging—is the way in which the economic pressures which really force change—competition at home and abroad, rising labour costs and the scarcity of manual skills, even inflation itself—as they flow more and more strongly, are being recognized for what they are—challenges to be met and overcome—so that the rate of change, both technical and organizational, is beginning to accelerate in many important sections of industry which have hitherto been relatively static.

What an agreeable surprise when a German buyer shopping for machine tools in this country a few weeks ago said of technical developments in the machine tool industry: 'The British have caught up with us'. A few years ago this could never have been said.

And on a lighter note I was greatly intrigued when visiting a dairy farm in Rutland recently to find a well-developed control system for milk production in which they were using a simple form of critical path analysis for plotting output for a year ahead, day by day, cow by cow, lactation by lactation. It was supplemented by charts and records demonstrating the results of various alternative policies, variations in costs and selling prices and so on, and provided the cowman with his daily programme; it had been introduced by the farmer's progressive college-trained son and was claimed by both father and son to have improved the efficiency of their farming significantly. What they now wanted was a cheap computer and they thought they might soon be able to anticipate the Annual Farm Price Review.

One notable consequence of economic pressures has been the rapid increase in the number of large, closely integrated corporations—mostly the product of mergers and takeovers—in technically complex fields such as electrical and aeronautical engineering, even machine tools, where reorganization has previously been slow and haphazard. Large corporations are of course no new thing in the traditional areas of mining, steelmaking, public transport, banking and so on, but even there close integration of detail operations had not, at least until the arrival of the computer, gone so very far. In engineering the small- and medium-sized firm has survived in a truly remarkable way, usually depending on its owner's reputation for service and quality and the manual skill of a handful of employees rather than on competitive efficiency and cost effectiveness. Mergers in this large and diverse industry have hitherto tended to be primarily financial groupings, designed to minimize competition and spread risk rather than to achieve integrated market-oriented design and selling policies, and the efficient use of productive resources.

But this attitude is now changing at increasing speed as technology itself imposed by competition makes its inescapable demands—demands which were brilliantly demonstrated and analysed in terms of the US economy by J.K. Galbraith in his book *The new industrial state.* As he presents it the introduction of technology demands capital resources, demands the application of extensive knowledge, demands precision in the performance of the task, requires specialized man-power, requires complex detailed organization, and all these in their turn demand a new style of manager, new attitudes in management, and new tools for management. Anyone who has had experience of the problems of integration and control following a merger or the formation of a group knows how big a change in management thinking is necessary—if the outcome is to be successful and not a mere conglomeration of unrelated activities.

For a long time too many boards of directors in this country, even of companies with a great record of successful achievement in traditional lines, failed to grasp the significance of scientific management methods and, whilst as I have said, many amalgamations took place for reasons other than the demands of technology, the demands of technological development were ignored.

In consequence, the need for education in management was obscured and the development of management education languished. The scientific approach was unacceptable—management was an art—it was very doubtful whether it could gain from academic instruction.

However, truly remarkable changes have been taking place over the last five years, sparked off in large measure by Lord Frank's Report (written in 1963) on the need for business schools, a report which contains the best appreciation that I know of the purposes which management training has to serve. As a result of widespread acceptance of the need for business schools and for management education as a continuing process throughout a man's career, we can now look forward to a generation of industrial managers increasingly familiar with modern management tools and more capable of working as specialists in a complex group than those who, like myself, were either uneducated in such matters or at best only self taught.

And if this expectation is fulfilled another important element in industrial progress, where we in this country have lagged behind, stands a real chance of being more fully recognized and understood. I refer to technological innovation, especially perhaps in the products and processes of mechanical engineering. And in conditions where useful innovation is usually the product of systematic research and of sponsored research and development programmes—in this environment where information, relevant and irrelevant, proliferates, but decision making must be soundly based on relevant knowledge—Aslib has a special part to play, a part which, as is evident from the papers at this Conference, is being grasped wherever opportunity offers.

The tale I have been telling this evening about the environment of your work is a mixture of disappointments and of hope. The sceptics have a strong case, but it is a case based on the past on attitudes which are changing and on mistakes of ignorance and indifference. There will be many more mistakes, but at least it can be claimed that in our own day we are experiencing two underlying developments of fundamental importance.

The changing structure of industry, which demands specialization and group activity towards a common objective, and the move towards a higher standard of relevant education in scientific method for those carrying responsibility in industry—two underlying developments which justify optimism for the future because proper organization and better education are the foundation of progress in a developed country. They are indeed essential if, having committed ourselves as a nation to earning our living by our brains, we and succeeding generations are to live less precariously than we have been doing in recent years.

I do not think that we need have any doubt that Aslib has a very real part to play in this task, so may I conclude by wishing you well and expressing my firm belief that in the years of change that lie ahead the demands of industry upon Aslib will continue to grow and as a result Aslib's fortunes will—in the words of your last report—continue to flourish.

ORGANIZATIONAL ASPECTS OF INFORMATION FLOW IN TECHNOLOGY

PROFESSOR T. J. ALLEN
Massachusetts Institute of Technology

Paper presented at the 42nd Aslib Annual Conference, Canterbury, 22nd–25th September 1968

FOR about five years now a small group of us at MIT have been conducting a series of investigations into the information needs of technologists, the manner in which these needs are presently met, the relation between various ways of fulfilling information needs and technological performance, and the nature of factors which determine the ways in which information needs will be fulfilled.

Since this series of research studies builds upon itself in a somewhat chronological pattern, perhaps the best way to present results is to go back to 1963 when we began and work forward to the present time.

We began in 1963 with the hope of studying the information consumption patterns of research and development projects. In pursuing this goal, we encountered two rather serious methodological difficulties, which we first had to overcome. Let me spend just a few minutes with these.

The first one is inevitable and omnipresent—that of obtaining a performance criterion for the project. We do, in all of our studies, want to determine some criterion of performance that we can relate to the behaviour we have observed.

The other is that each R and D project, by definition, is unique; if it was performed previously, it is no longer research. You can gather a lot of data on a particular case, and still be faced with the question of how much you can generalize to any other case.

There are two ways of getting around this latter difficulty. The first one is rather obvious. You gather data on a large number of projects, and control for the variation in the substance of the problems through statistical techniques.

The second, which I think is a bit more efficient, is to locate instances of matched pairs of research projects—in other words, two or more teams working on the same project. This is the strategy that we have employed. We have found a number of government-sponsored parallel projects in the early preliminary design phases at which time the government often funds two or more teams to perform the same project.

We have also found a number of similar instances in commercial projects. In other words, there are two or three teams, in some cases as many as twenty-five, working on essentially the same project. I will report today on some of our earliest findings on a number of government-sponsored projects.

The use of matched pairs also allows us to solve, to a large degree, the criterion problem. It is much simpler to obtain a relative performance measure on two identical projects, than it would be to obtain absolute performance measures. In other words, someone who is knowledgeable and competent in the required technical areas can determine which of the two teams produced the better solution to a particular problem. It is easier dealing, of course, on a sub-problem basis level rather than on the overall project evaluation. It is far easier, for example, to assess which of two competing teams has the better power supply design and which has the better guidance package design than it would be to get absolute evaluations for these subsystem designs.

Before I go into our results, I will describe very briefly how the data were collected.

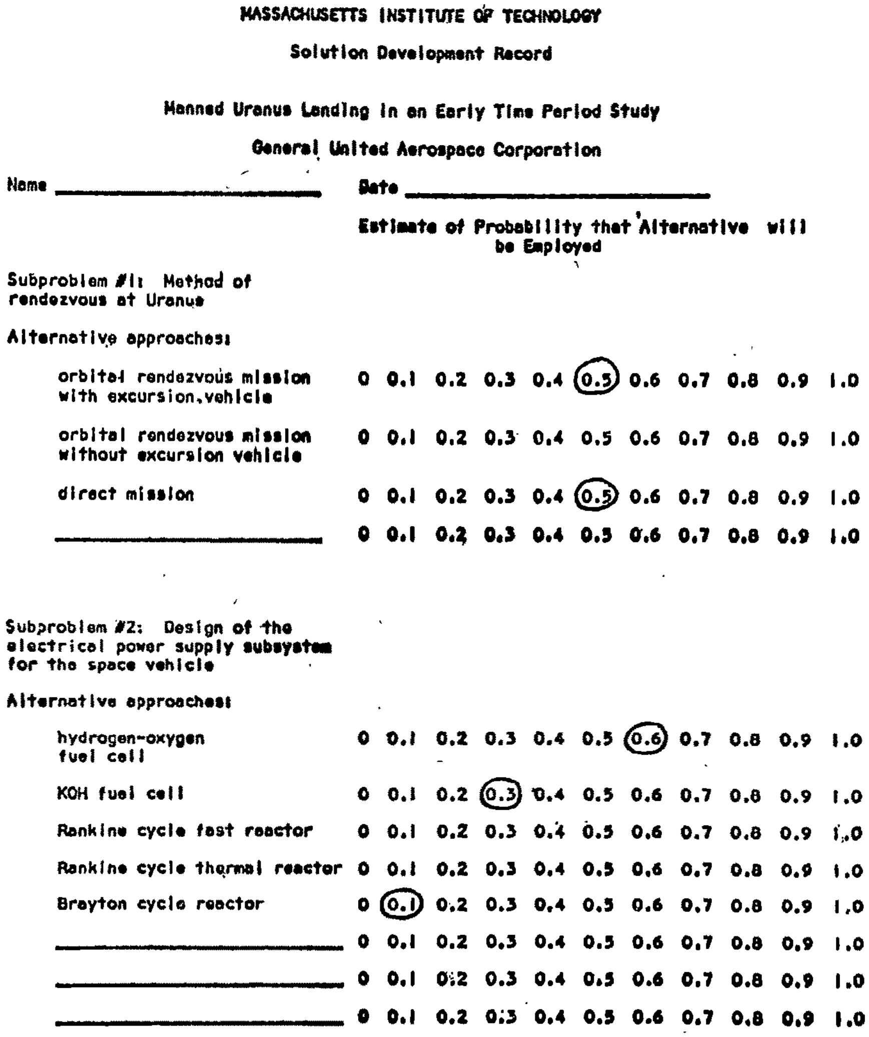
Figure 1 shows our principal data-gathering tool. This is what we have come to call a solution development record. It is very simple. First of all, when we learn of a new project which is about to be initiated, we obtain the work statement for it and we factor the project down into a number of sub-problem areas, which are the units we study.

At the outset of the project we interview the individual who is primarily responsible for each subproblem. Figure 1 illustrates a typical subproblem. We ask the engineer at the very onset what approaches to the solution of this particular problem he is going to consider. We have him list them, if he is considering more than one, and we indicate them on a form that is mailed weekly to the principal investigator. Beside each alternative approach, we give him a series of numbers from zero to one. We tell the engineer that these represent the probability estimates. When the respondent receives the form on a particular day, he is to merely circle a number next to each alternative which represents his subjective probability that that approach will be the one upon which he will finally settle.

If he were, for example, considering only two approaches believing that they exhausted the field of possibilities, but was completely uncommitted between the two, he would circle 0.5 for each, as shown. Eventually, one of these goes to 1.0 and the rest go to zero, and we have a record of the engineer's decision process during the project.

Figure 2 illustrates plots over time of the actual probabilities that were submitted by two engineers who were working on the same design. Each considered five approaches and traded off among them during the course of the project. There is an overlap in the first three approaches. You can see that over a time we get a record of the trade-off process among alternatives. Armed with this, we can return after the project has been completed, place the plot before the engineer and ask him specific questions about it. If we were to ask him to simply recapitulate his solution process, I am afraid we would not be able to obtain very much information. Armed with the plots, however, we can ask specific questions about the reasons for changes. In the middle of August, for example, he may have come up with a new approach, and he can tell us what it was that first suggested this approach to him.

This method has enabled us to learn quite a bit about the types of information channels and information-gathering behaviour of the people we studied. Today, I am going to concentrate on one particular function that the information system provides to the engineer, and that is the actual generation of the solution



MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Solution Development Record

Manned Uranus Landing in an Early Time Period Study

General United Aerospace Corporation

Name ______________________ Date ______________________

Estimate of Probability that Alternative will be Employed

Subproblem #1: Method of rendezvous at Uranus

Alternative approaches:

orbital rendezvous mission with excursion vehicle	0	0.1	0.2	0.3	0.4	[✓ 0.5]	0.6	0.7	0.8	0.9	1.0
orbital rendezvous mission without excursion vehicle	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
direct mission	0	0.1	0.2	0.3	0.4	[✓ 0.5]	0.6	0.7	0.8	0.9	1.0
______________________	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0

Subproblem #2: Design of the electrical power supply subsystem for the space vehicle

Alternative approaches:

hydrogen-oxygen fuel cell	0	0.1	0.2	0.3	0.4	0.5	[✓ 0.6]	0.7	0.8	0.9	1.0
KOH fuel cell	0	0.1	0.2	[✓ 0.3]	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Rankine cycle fast reactor	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Rankine cycle thermal reactor	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Brayton cycle reactor	0	[✓ 0.1]	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
______________________	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
______________________	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
______________________	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0

FIG. I.

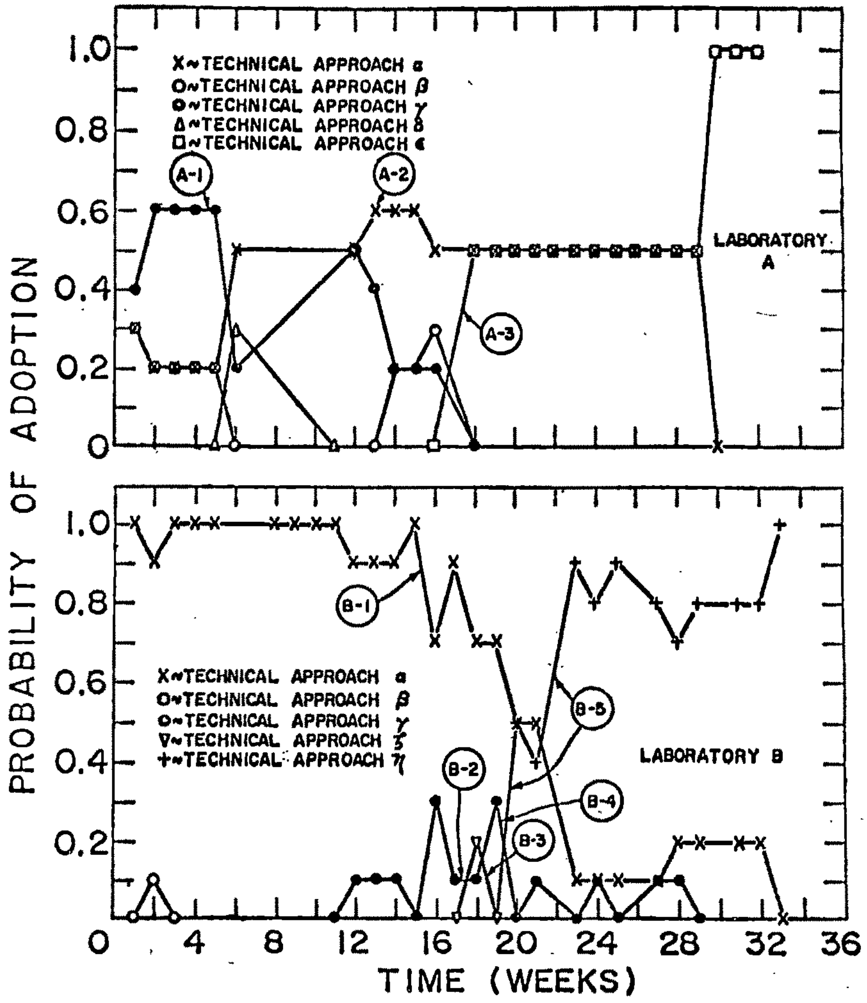


FIG. 2. *Design of Subsystem to Determine Antenna Position.*

alternatives—the generation of ideas. We are going to look back and see from which channels these ideas were originally derived. In this particular example (Figure 2), with regard to approach Epsilon, the story goes something like this. The researcher was going along, trading off among three alternatives, none of which really satisfied him. He was really searching around for other possibilities, and you can see other ideas coming up here and there in the plot.

About halfway through the project, a friend attended a meeting of the Society of Automotive Engineers and heard a paper that suggested an alternative of possible interest to our friend the engineer. He told him about the paper, gave him the name of the author; the engineer contacted the author, learned of a couple of literature references, looked up the references, and learned of a vendor who had the potential for making this particular device. He contacted the vendor, got some cost estimates and so forth—and as you can see, he carried it along during this period he was doing this information gathering—and eventually decided on this approach. So you see there were a number of messages that came to the engineer which suggested this alternative to him; the SAE paper, his friend, the literature contact that he made, the vendor, and so forth.

All of our interviews are tape-recorded and later coded for the sources from which these messages arrived.

In Table 1, we are shown a number of the channels that were examined as potential sources of ideas. We coded our tapes for these—for information coming from these particular channels. Each one of them is defined according to this table.

TABLE 1 *Typical Information Channels Considered in the Study*

literature	books, professional, technical and trade journals and other publicly accessible written material.
vendors	representatives of, or documentation generated by suppliers or potential suppliers of design components.
customer	representatives of, or documentation generated by the government agency for which the project is performed.
external sources	sources outside the laboratory which do not fall into any of the above three categories. These include paid and unpaid consultants and representatives of government agencies other than the customer agency.
technical staff	engineers and scientists in the laboratory who are not assigned directly to the project being considered.
company research	any other project performed previously or simultaneously in the laboratory regardless of its source of funding.

Table 2 shows the results of the message count on nineteen of these projects. In the first column we see the messages that were received. These are the messages which suggested any alternative that was considered.

TABLE 2 *Messages Received and Messages Accepted by R&D Scientists and Engineers as a Function of Information Channel (nine parallel sets comprising* 19 *R&D projects)*

Channel	*Messages received*	*Messages accepted*	*Acceptance ratio*
literature			
scientists	18	6	0.33
engineers	53	21	0.40
external sources			
scientists	5	5	1.00
engineers	67	32	0.48
vendors			
scientists	0	0	—
engineers	101	33	0.33
customer			
scientists	0	0	—
engineers	132	41	0.31
technical staff			
scientists	1	0	0
engineers	44	24	0.55
company research			
scientists	1	0	0
engineers	37	20	0.54
unknown	75	6	—

Differences in acceptance ratios between information channels are statistically significant at the 0.01 level: technical staff and vendors, external sources and vendors, technical staff and customer, company research and customer, external sources and customer. The difference between ratios for external sources and vendors is statistically significant at the 0.05 level.

Messages accepted are defined to be the messages which generated the solution — the one alternative which was finally accepted.

Taking the ratio between the two measures, as a first-order performance criterion, we see there is quite a variance in these acceptance ratios. They vary for engineers from about 0.30 all the way to 0.55.

Figure 3 shows that engineers differ quite a bit from scientists (at least from this limited sample) in their information-gathering behaviour. The literature is much less used by engineers. Vendors are used quite a bit. The acceptance ratio is rather low for vendors. The customer suggests a lot of possibilities, few of which are accepted. The technical staff suggests some. It has a very high acceptance ratio. Company research has a very high acceptance ratio. External sources have a relatively high acceptance ratio.

These are the three channels that were the highest: company research, technical staff, and external sources. They are what you might call expert sources. A man goes to them because he feels they have more knowledge than

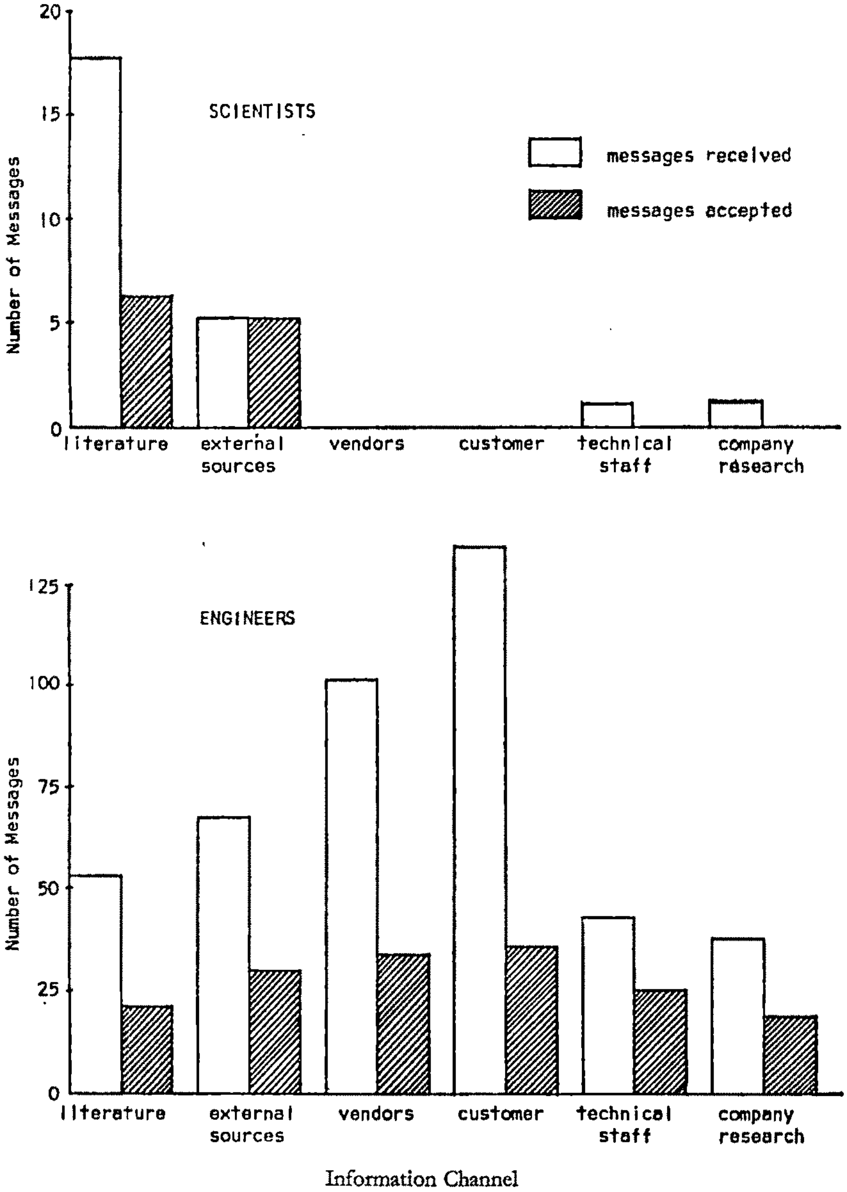


FIG. 3. *Messages Received and Messages Accepted by* R. *&* D. *Scientists and Engineers as a Function of Information Channel.*

he in a given area. He goes to them as experts, so there is something of a halo over any information which they give him.

In the sample of projects for the subproblem solutions, we were able to divide our sample into those that were rated higher, and those that were rated lower. You lose quite a lot of data in this way, because the evaluator in the government laboratory is often simply unable to discriminate between the technical quality of solution; one is as good as the other and the majority of our ratings are tied scores in this way. However, for 27 of the solutions we were able to get very definite distinctions in quality.

Dividing our sample into higher- and lower-rated solutions (Table 3), we find that using the literature contributes to twice as many lower-rated solutions as higher-rated solutions. Statistically the difference is not extremely great; the last column in Table 3 represents the probability that these results could have been generated by chance. We see that for the literature such a difference could occur by chance about 14 per cent of the time.

External sources generate more lower-rated solutions. In other words, they perform poorly. This could have occurred by chance only three times in a hundred.

Both vendors and the customer supply a nearly equivalent number of both high- and low-rated solutions.

Technical staff leans toward the high side, but again the results are not too significant.

Company research produces three times as many higher-rated as lower-rated solutions. The probability that this could have occurred randomly is about six one-hundredths.

Besides testing the performance of individual channels, we made a prediction concerning the performance of two classes or types of channel. Specifically, we hypothesized that channels whose origin lay outside of the laboratory organization would not perform as well as those inside. To test this hypothesis we had to first divide all of our solutions into three mutually exclusive sets (Table 4): (1) solutions that were derived from channels outside the laboratory; (2) solutions derived from channels inside the laboratory only; and (3) some solutions that were derived from a combination of both kinds of channel, or from neither.

TABLE 3 *Sources of Messages Resulting in Higher- and Lower-Rated Solutions. (27 Subproblem Pairs)*

	PERCENTAGE OF SOLUTIONS SUGGESTED BY MESSAGES RECEIVED THROUGH EACH CHANNEL		
Information Channel	*27 higher-rated solutions*	*27 lower-rated solutions*	*Level of statistical significance*
literature	11%	22%	0.14%
external sources	7.4	26	0.03
vendors	30	30	0.50

customer	56	44	0.21
technical staff	22	15	0.24
company research	22	7.4	0.06

The percentages in Tables 3 and 5 are distilled from 2 × 2 contingency tables in the following manner:

Taking the first row, literature, as an example, the original contingency table looked like this:

	Solution rating: high	Solution rating: low	
Number of solutions based at least in part on messages from the literature	3	6	3/27 = 11% 6/27 = 22%
Number of solutions not based on messages from the literature	24	21	
	27	27	

TABLE 4 *Sources of Messages Resulting in Higher- and Lower-Rated Solutions (27 subproblem pairs)*

Information channel	*Number of higher-rated solutions suggested*	*Number of lower-rated solutions suggested*
Channels outside the Laboratory external sources of vendors but not technical staff of company research (ES∪V) ∩ (TS∪CR)	6	10
Channels inside the Laboratory technical staff or company research but not external sources or vendors (TS∪CR) ∩ (ES∪V)	7	1
Other Channels both or neither (TS∪CR) ∩ (ES∪V) or (TS∪CR) ∩ (ES∪V)	14	16

$x^2 = 5.63$, p 0.03

The external channels, we see, generated fewer high-rated solutions than low-rated solutions. The internal channels generated considerably more higher-rated than lower-rated solutions. This is statistically significant and quite strong.

So we see even more clearly that channels within a man's own organization tend to show a better performance than do channels outside. Now, if this were an isolated finding and resulted only from this particular study, I would not draw very strong conclusions from it, but it is something that keeps recurring.

Table 5 shows a summary of the evidence from several studies. First of all, we saw this phenomenon in a number of proposal competitions. We looked at the amount of time people spent with the literature, channels inside the laboratory organization, and channels outside the laboratory organization. We then correlated these with the technical quality of the proposals. We found no correlation between the use of the literature and technical quality. The literature appears consistently in the middle on our ratings; it is mediocre, at best, in its performance.

TABLE 5 *The Impact of the Organization in Technology*

STUDY	PERFORMANCE RESULTS	
	Internal channels	*External channels*
Allen (1964). Twenty-two R and D proposal competitions	Weak positive correlation between use of channel and evaluation of technical quality of proposals.	Significant negative correlation between use of channel and evaluation of technical quality of proposals.
Allen (1966 (*a*), 1966 (*b*)). Nine sets of parallel R and D projects (nineteen projects)	Produce messages resulting in significantly more higher-rated solutions and fewer lower-rated solutions than would be expected by chance.	Produce messages resulting in significantly fewer higher-rated solutions and more lower-rated solutions than would be expected by chance.
Shilling and Bernard (1964). Scientists in sixty-four laboratories performing biological research	Significant direct correlations between degree to which internal discussion groups are used and seven of eight measures of laboratory performance.	Significant inverse correlations between degree to which paid consultants are used and all of eight measures of laboratory performance.
Hagstrom (1965). Seventy-nine scientists in the 'formal physical and biological sciences'	Correlation of channel use with performance positive but about half that found for sources outside the department (but within discipline).	Positive correlation between channel use and performance twice the magnitude of the correlation for channels within the academic department.

Channels within the laboratory show a mild positive correlation, i.e. a weak positive correlation between their use and the technical evaluation.

Channels outside the laboratory, however, show a very strong inverse or negative correlation. On fourteen of the proposal competitions, in which we found more than one team using outside channels, we found negative correlations with the technical performance of the proposal.

Another study performed by Shilling and Bernard (1964) at George Washington University a couple of years ago in which they studied scientists in sixty-four laboratories performing biological research, showed inverse correlations between eight measures of laboratory performance and the extent to which paid consultants were used. Looking at the extent to which internal discussion groups were used, seven of the eight measures of laboratory performance showed a positive correlation for internal channels and a negative correlation for external channels.

We have one exception here. In a book published a year ago, in which the author studied seventy-nine scientists in the 'formal' physical and biological sciences, he found a very strong positive correlation between the extent to which, as information sources, they used other individuals outside of their own academic department and their rated performance in terms of papers published, and a much weaker, but still positive correlation between performance and the extent to which they communicated within their academic department. The people outside the academic department were within the same discipline as the scientists who were queried.

So this is one piece of evidence that appears conflicting at first. The distinction here, however, is that in the first three studies, the people were all in industrial or government organizations. None of them were university people. In the study by Shilling and Bernard, the university scientists did not use paid consultants, and for the particular part of the study which we have cited, university laboratories were taken out of the sample.

What is happening in the Hagstrom case may well be explained by the fact that the scientists are not in the types of organizations that we have in government and industry. The academic department is not a very important organization for their scientists. The real social system to which they owe their allegiance is the invisible college. We find that as long as they communicate within their invisible college, the communication is efficient.

With the industrial or government laboratory, we see that the organization imposes an impediment to communication. There is an impedance at this organizational boundary that introduces what might be called semantic noise (cf. Bar-Hillel and Carnap, 1953).

How does this come about? I think that over a time organizations develop a coding system, a common way of viewing the world which makes communication within the organization relatively efficient. This shared knowledge and shared coding scheme, a shared way of looking at events and describing them, improves and enhances communication. On the other hand, in the area of communicating across the organizational boundary, you will find that there may be a mis-match in the coding scheme, and this can introduce semantic noise, with a subsequent loss in efficiency.

Just to recapitulate what we have covered up to this point, we find that there is a problem centring around this differential in performance between internal and external channels. We also find that the literature is little used by engineers. The engineers just do not read. They have little contact with the literature.

How do we get at this a little better? One thing that occurred to us was to go back and look at the people who were the internal sources of information, the technical staff, to study them and see where they got their information. It must have come from somewhere. Perhaps these people are able to bridge the organizational boundary and communicate and transform between the two coding schemes. You never know, we might even find some engineers who read! When we look at the amount of contact between the average engineer and his technical literature, the situation is somewhat distressing. But actually in doing this we are looking only at the mean of a statistical distribution and ignoring its variance. It may well be that there are some engineers who do read, and in turn transmit the information that they gain to their colleagues in the organization.

To test this possibility we initiated a second series of studies within R and D laboratories looking at the information flow both within and into the laboratories. I am going to report on the first two of these today. We have since furnished a third and are still in the process of analysis, but it looks as though the results that I will present today are substantiated by the third study.

The first study was done in a small laboratory in the Boston area. We picked a small laboratory because we felt it would be easier to handle. There were thirty-four professionals in this laboratory.

The second study was performed in a forty-eight-man department of a medium size (5,000 employees) aerospace firm, and the third study is of a group of 400 engineers and scientists in a very large (approximately 100,000 employees) aerospace firm.

Our approach to studying communication network structure is very simple. We administered a questionnaire which measured a number of possible sociometric relations which might exist among the members of a laboratory (Table 6).

TABLE 6 *Sociometric Relations Studied*

Socialization	Name the three or four persons from the laboratory with whom you meet most frequently on social occasions.
Technical discussion	Name the three or four people with whom you most frequently discuss technical matters.
Special information	(obtained during the interviews subsequent to the questionnaire)—the source, if any, from which the respondent reported having received special information that influenced him during the course of his last completed project.
Research idea	To whom in the laboratory would you first express an idea for a new research project.

Figures 4 and 5 illustrate the pattern of two sets of relationships among the members of laboratory B (the first of the three laboratories described above). In Figure 4, the arrows indicate the direction of social contact choices; Figure 5 shows the pattern of technical discussion choices. The large circle labelled 'non-Ph.D.' in Figure 4 (*b*) represents the Ph.D. to non-Ph.D. choices, and shows very few social contacts in this direction. The circle labelled 'all Ph.D.s combined' in Figure 4 (*a*) gives an indication of which non-Ph.D.s choose into the Ph.D. group. Nine non-Ph.D.s do so, but in only two cases, subjects

24 and 28, is the choice reciprocated. Reciprocal choices are indicated in the diagram by double-headed arrows.

Sociograms are compared for two or more types of choice (e.g. technical discussion and socialization), by comparing the degree of overlap between two actual networks with the amount of overlap which would be expected under chance conditions. Since the number of overlapping choices expected by chance will vary as a function of the number of sociometric choices made by each individual, an expected number of overlaps is computed for each person who returned the questionnaire. This expected number is based on a binomial probability model in which the probabilities of overlap and non-overlap are a function of the number of actual choices made by each individual respondent.

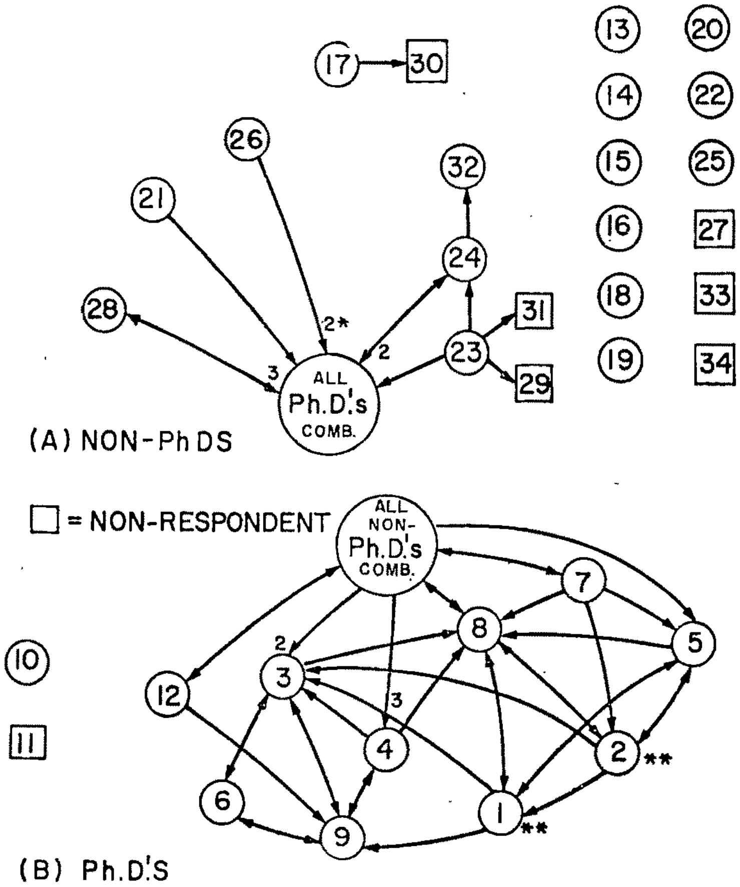


FIG. 4. *Social Contact—Choices.*

* Where more than one connection exists, a number next to the arrow head indicates the number of connections.

** Numbers 1 and 2 are the research directors of laboratory B.

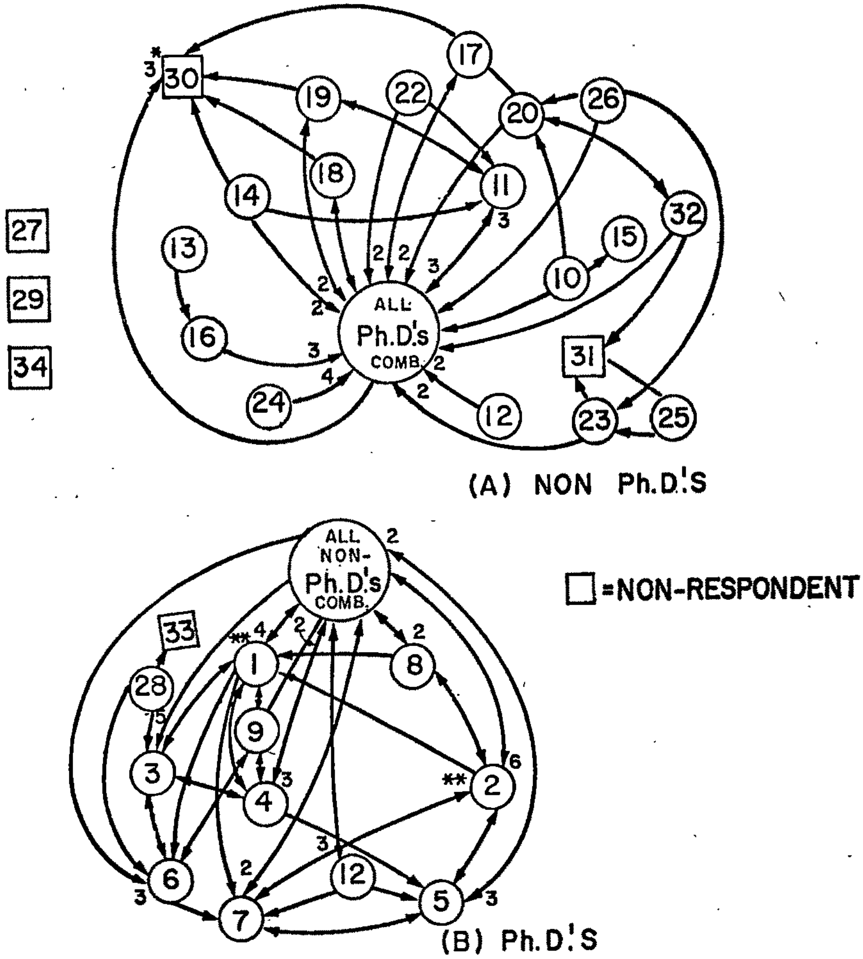


FIG. 5. *Technical Discussion—Choices.*

* Where more than one connection exists, a number next to the arrowhead indicates the number of connections.

** Numbers 1 and 2 are the research directors of laboratory B.

Expected values for the total sample are obtained by summing all of the individual values. The observed distribution of overlaps is then compared with this expected distribution by means of a one-sample Kolmogorov-Smirnov Test.

In Figures 6 through 9, the bar graphs compare the number of overlapping sociometric choices which were observed with the number predicted by the random model we have described.

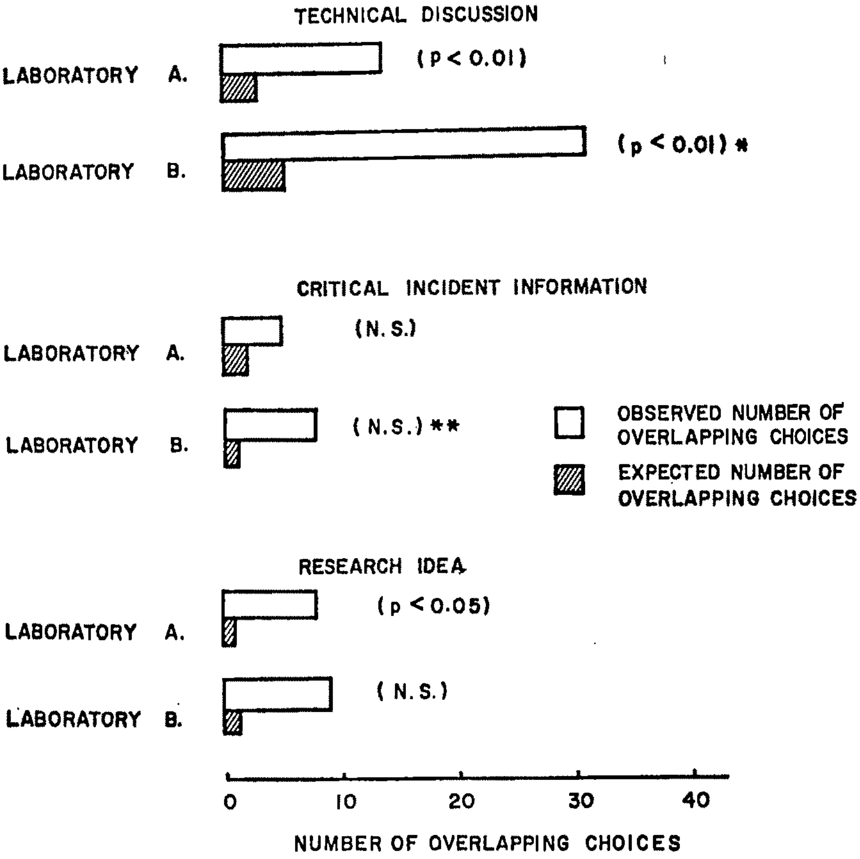


FIG. 6. *Overlap Between the Social Contact Network and Three Technical Information Flow Networks in an R. & D. Laboratory.*

* Determined by Kolmogorov on sample test.

** N.S. = Difference not statistically significant.

Figure 6 presents results of the comparison of three communication-oriented sociometric choices with the social contact choice. There is strong agreement between the selection of individuals for socialization and technical discussion in both laboratories. In laboratory B this is due in part, but not entirely, to the rather tight clique found among the Ph.D.s in the laboratory. As a matter of fact, among the Ph.D.s alone, the amount of overlap is not significantly above chance. The networks for critical incident information and for new research ideas show a decidedly weaker relation to the social contact network in the laboratory.

A question now remains concerning the impact of the formal organizational structure upon communication. In laboratory A, organizational relationships were taken directly from the departmental organization chart. People were considered to be members of common work groups when they reported to the same first line supervisor; the work group included each first line supervisor. In laboratory B, no organization chart was available. Since the organization of that laboratory is quite flexible and revolves around a number of long- and short-term projects, all under one or two research directors, consideration of formal structure is restricted to the *ad hoc* project groups. The respondents in laboratory B were asked to name 'the people whom you consider to be members of your present work group'. Figure 7 shows that while in both laboratories, much of the socialization occurs within work groups, the two networks are somewhat independent and should exert independent influences on information flow. If anything, the formal organization exerts an even stronger influence on communication (Figure 8) than does the informal socialization network. Work group structure influences not only technical discussion but new idea flow as well. This is not at all surprising, especially in laboratory A, where the most frequently named recipient for new research ideas is the naming individual's immediate superior.

Controlling for the effects of the formal organization, by comparing only those social and technical discussion links which are external to each individual's work group (Figure 9) produces a somewhat weaker relationship than that found when work group members were included. The formal organization is, then, the more important, but certainly not the sole determinant of information flow.

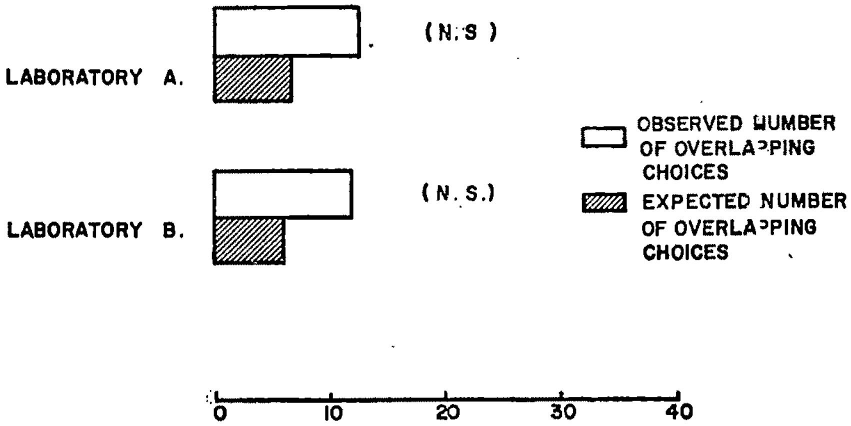


FIG. 7. *Overlap Between Work Group Structure and the Socialization Network in Two* R. *&* D. *Laboratories.*

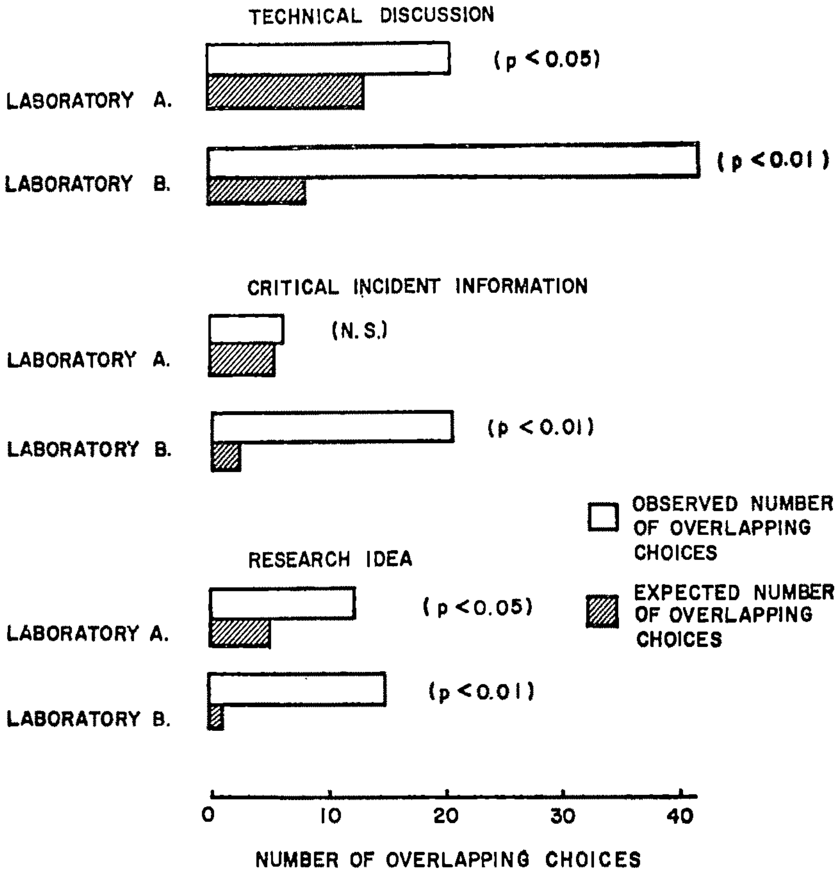


FIG. 8. *Overlap Between Work Group Structure and Three Technical Information Flow Networks in two R. & D. Laboratories.*

Figure 5 shows quite clearly that some individuals are much more highly chosen than others for technical discussion. These highly chosen individuals, or sociometric 'stars' may well be key links between the internal information network of the laboratory and the scientific and technological communities outside of the laboratory. To examine this possibility, the 'stars' in two sociometrically-determined information networks* will be compared with their colleagues to determine whether they display any systematic differences in their information gathering behaviour. Specifically, it is hypothesized that the stars will make greater use of such sources as literature and friends outside of the organization; in other words, that they will act as 'technological gatekeepers'.

* Stars being, in the first case, those people who are highly chosen for technical discussion, and in the second, those who were cited as sources of critical incident information. This analysis was performed in laboratory B only, because although stars existed in laboratory A, nothing is known of their information gathering behaviour. An attempt to go back to this laboratory and obtain data on the information gathering behaviour of stars and a matched sample of non-stars was abortive, as the result of poor co-operation.

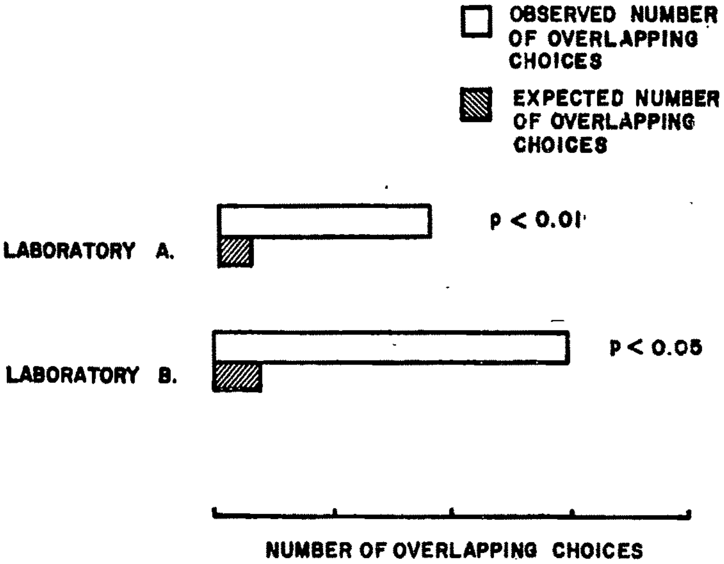


FIG. 9. *Overlap Between the Socialization and Technical Discussion Networks Exclusive of the Work Groups in a R. & D. Laboratory.*

TABLE 7 *Comparison of Communication Behaviour and Technical Discussion Choices*

	NUMBER OF TIMES CHOSEN ON TECHNICAL DISCUSSION MATRIX		
Communication characteristics	*Six or more*	*Four or fewer*	*Level of statistical significance*
Percentage who are above median in using personal friends outside the laboratory as an information source	64%	25%	0.06
Percentage who are above median in using technical specialists within the laboratory as an information source	50%	40%	0.47
Percentage who are above median in total number of technical periodicals read	88%	40%	0.01
Percentage who are above median in number of professional and scientific periodicals read	75%	35%	0.001

* Based on Mann-Whitney U-test performed between the two groups.

In considering those members of the laboratory who are highly chosen for technical discussion* (Table 7), we find that the sociometric stars have more exposure to both the literature and to oral sources outside of the laboratory than does the average employee of the laboratory. This contrast is especially pronounced in the case of scientific and professional literature, that is journals published under sponsorship of scientific and engineering societies.

When requested to indicate the source of any information which influenced the course of their most recently completed research projects, twelve people cited seven other individuals within their own laboratory as the source of such information. In Table 8 these seven people are compared in terms of their own information gathering behaviour in the same manner as were the technical discussion stars. We again see the pattern of greater contact with experts outside of the organization and more exposure to the literature.

TABLE 8.—*Comparison of Communication Behaviour and Identification as the Source of Special Technical Information During One of the Laboratory's Projects*

Communication characteristics	*Seven individuals cited*	*Others*	*Level of statistical significance*
Percentage who are above median in using personal friends outside the laboratory as an information source	67%	30%	0.10
Percentage who are above median in using technical specialists within the laboratory as an information source	57%	40%	0.17
Percentage who are above median in total number of technical periodicals read	100%	45%	0.05
Percentage who are above median in number of professional and scientific periodicals read	86%	35%	0.03

* Based on a Mann–Whitney U-test performed between the two groups.

Individuals who are highly chosen as sources of potential sources of technical information are considerably different from their colleagues. They have greater contact with technical people outside of the organization and are more exposed to the technical literature. Furthermore, they all rely to very much the same degree upon internal consultation.

There appear then to be two distinct classes of individuals within this laboratory. The majority have few information contacts beyond the bound of the organization. A small minority in contrast have rather extensive outside contacts and furthermore serve as sources of information for their colleagues. There is then evidence of a two-step flow of information in the laboratory studied. Six or seven individuals act as technological gatekeepers for the rest of the laboratory. As further support, it was found that two of these six or seven people were responsible for introducing all four of the 'most important technical ideas' that had been introduced into the organization during the preceding year.

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* Those who receive six or more technical discussion choices (eight respondents). This represents a split at one standard deviation above the mean number of technical discussion choices.

The gatekeepers themselves show some variation in the type of information sources they use. Some rely more upon the literature than upon oral sources, while some operate in reverse. A comparison of relative exposure to technically oriented friends outside of the organization and to the scientific and professional literature shows a slight positive correlation (Kendall Tau = 0.27), but the relation does not approach statistical significance ($p = 0.21$). Quite fortunately, it would appear for the laboratory, the gatekeepers do not all tend the same gate.

In summary, I would like to recapitulate the principal conclusions of the studies. First of all, we find a serious misalignment between the quality of ideas generated through the channel study, and the frequency with which these channels are used by engineers. In other words, we found that people were using channels such as vendors and customers to a greater extent than seemed to be warranted by the evaluation that we were able to obtain. Secondly, the literature is not greatly used by engineers and is mediocre, at very best, in its performance.

The third conclusion is that the better performing groups rely more than the poorer performers upon sources within their laboratory—the technical staff and other company research programmes contrasted with sources outside the laboratory organization.

Our fourth and final conclusion is that a mismatch in information-coding schemes appears to be responsible for the ineffectiveness of communication across the organizational boundaries. The existence of key individuals, whom we call technological gatekeepers, provides a means of surmounting this organizational boundary impedance, and it is up to us, as research managers, to locate these individuals and to make use of them, to encourage them to develop a consultant function. I think very often we discourage this sort of behaviour on the part of potential consultants within our laboratories. We do not reward important consultants. We reward them for work on projects to which they are assigned, and the time they spend in actual consulting work tends to detract from their performance evaluations. I think that management should recognize the internal consultant as a very important contributor in R & D laboratories and align its reward systems accordingly.

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DISCUSSION

Professor Allen summarized his paper and went on to give a short account of work continued since it was written.

The average engineer, he said, derived only 10 per cent of his information from the literature, though the term average needed qualifying. The rest he obtained from internal and external consultants. It was found that though outside consultants were frequently used their use did not affect performance so much as the use of inside consultants. This was the result of 'semantic noise'; a communication barrier developed between an organization and the world outside, while insiders developed their own 'language'.

It was clear, however, that outside information was used and Professor Allen demonstrated that it came to particular personnel (which he called 'gatekeepers') within the organization, who digested it for their colleagues. Thus, incoming information was subjected to a two-step process.

An attempt had been made to identify gatekeepers, and it was shown that these people tended to be both PhDs who had acquired (through training and status) strong contact with the outside, and had substantial service with the organization, giving rise to strong internal contacts. Other features of gatekeepers and others were put forward including the observation that gatekeepers were also 'high contributors' as measured by patents produced and papers published.

The highly complicated communication network of an organization could, he said, be simplified, and subnetworks could be identified. These involved groups, one of which was a key group and contained a high proportion of gatekeepers. It was seen that there was a high degree of rationality in an informal communication system.

Professor Allen closed with an account of some work which showed that the law of least effort was applied by engineers in their choice of information sources. Of the three criteria, 'perceived accessibility' 'perceived ease of use' and 'perceived technical quality', the first was most important, the second minimal, and the third negligible.

Mr J. Farradane (City University) said it had long been known that engineers did not read and that there were gatekeepers. He was, however, disturbed to think that a pecking order existed where PhDs talked only to each other. He further commented that whereas Professor Allen talked of the individual going to the information service, the good information service went to the individual.

Professor Allen agreed that status was an important factor in communications: higher groups tended to be more cohesive. He thought that PhDs should be encouraged to communicate downwards.

Dr W. E. Batten (ICI) asked whether 'technical quality' was as perceived by the 'victim of the moment' or by the investigator. If the former, would it not automatically rank as the highest factor?

Professor Allen replied that, surprising as it seemed, the parameter in question was as perceived by the subject.

Mr J. M. Myers (SIRA) asked whether there was any observed correlation between use of external consultants and possession of in-house specialists.

Professor Allen replied that there was. An organization faced with a problem calling for specialist help that it did not itself possess went outside. However, it had been observed that large organizations also went outside even though they had the relevant specialists. This was because of ignorance of the existence of inside specialists and the difficulty of approaching the relevant person within the organization.

D. E. Bagley (HERTIS) asked whether gatekeepers were better informed about sources of information or whether they possessed particular personality traits. If the former, information use should be better taught at universities.

Professor Allen agreed that it should be possible to 'grow' gatekeepers. As he had shown, PhDs were more used to contact with both the literature and other specialists. One personality test had been tried, but without positive results.

Mr Dickson (Ealing Technical College) asked whether any gatekeepers in the study had been identified as librarians, and whether librarians should be trained in social science methodology.

Professor Allen replied that no gatekeepers were librarians, but thought there was certainly a gap that could be filled by librarians with specialist knowledge. For example, it would be advantageous if information technologists could advise on the design and architecture of R & D buildings.

CRITERIA FOR EVALUATING TECHNICAL LIBRARY EFFECTIVENESS

C. J. WESSEL

John I. Thompson & Company, New York

Paper presented at the 42nd Aslib Annual Conference, Canterbury, 22nd–25th September 1968

Introduction

IN July 1966 John I. Thompson & Company accepted a contract with the Picatinny Arsenal, US Department of the Army, to perform a study aimed at developing 'Criteria for evaluating the effectiveness of library operations and services' under the ATLIS Program (Army Technical Library Improvement Studies). The study was divided into three phases aimed at:

I A literature search to reflect the current 'state-of-the-art' covering library standards and the methods of evaluating libraries developed up to the present.

II A phase in which to gather and evaluate any data required from Army Technical Libraries, from available surveys already published, or from any other sources, by which to develop criteria.

III A phase in which to establish and validate the criteria.

Phases I and II of the study are now complete. Phase III is in progress and is expected to be completed by the late fall of 1968. The reports of Phases I and II are already available for detailed study and that of Phase III will be available soon. The purpose of this paper is to present some of the findings of the study.

Although it is felt that certain of the concepts described, as well as the methods developed for applying them, have been investigated sufficiently to offer them for practical use as criteria, it is foreseen that they will require considerable use and experimentation before becoming sufficiently understood and simplified in detail for widespread application. Certain of the criteria and methods of their implementation are not simple. However, it is hoped that unfamiliarity with such methods will not deter librarians or those charged with the management of organizations in which libraries serve from considering the criteria in the detail they require for successful use.

The Approaches

There is a considerable literature bearing in various degree on the subject of effectiveness of libraries in serving their clients and sponsors. Our efforts at reviewing this body of knowledge may be viewed in our Phase I report.[1] There is also a very considerable mass of evidence of the efforts in the past to analyse and improve the effectiveness and efficiency of numerous industrial operations and processes. Industry is based on profit and loss. Industries which do not operate on a profitable basis usually do not survive. Profits are usually determined by the comparative efficiency of a given firm and its competitors. Efficiency can be regarded as effectiveness viewed from a cost aspect. Although the nature of library operations and services may not be directly analagous to those of industry, certain industrial considerations appear to be worthy of trial.

It is not our purpose in this brief paper to get deeply into a discussion of all aspects of effectiveness, efficiency, the nature of criteria, and so on. We do, however, present our views on this matter in the Phase II report of this study.[2] We point out here, moreover, that certain aspects of library operations and services lend themselves more readily to precise measurement than do others. We will be concerning ourselves with certain of both aspects. We would like to think that our purpose of striving for an extension of quantitative methods to the less quantitative concepts has succeeded to some degree.

As the work of this study progressed it became apparent that there are several approaches which may be taken toward developing criteria. These resolved themselves into five types. The first approach visualized by the authors was the rather obvious one of seeking out criteria which already exist either in the literature or in use in Army Technical Libraries. In this case it was recognized that criteria are not always plainly labelled as such. Sometimes they are simply taken for granted. In other cases they may be called 'policies' or 'instructions' and so on. Because the authors are not bent on necessarily 'creating' criteria but rather trying simply to discover them, it is equally satisfactory if they are already discovered and in use.

A second approach was based on gathering mission statements of Army Technical Libraries and of the parent organizations which they serve. The purpose here was to analyze these documents to determine if the statements adhere to a fixed pattern which might be used as a base for establishing criteria of effectiveness.

The third approach is based on the fact that there exists a substantial body of library statistics obtained in several studies of federal libraries. It was judged that a review of these data on the basis of correlation analysis might provide certain insights into current practices that could form the basis of effectiveness criteria.

The authors visualized a fourth approach based on the utilization of certain management techniques. In order to consider this possibility, part of the Phase I study was devoted to exploration of the literature of the management 'sciences'. This resulted in the preparation of a matrix showing which library services and operations might lend themselves to analysis by a variety of the management techniques or tools.

The fifth approach which the authors thought worthy of investigation depended on the assumption that for every library there is a well-defined mission statement, so prepared that it is a logical outgrowth of the mission statement of the parent organization it serves. From such a library mission statement it would follow that goals and objectives required to fulfil the mission could be written down; the experienced librarian could then enunciate the services his library should perform to fulfil these goals and objectives and could derive the operations his staff should perform to produce those services. After preparation of such statements in a recommended format, the librarian could compare theory with the real-life situation in his library. By application of a modified 'utility analysis' technique, the librarian would thus have a basis for assessing the effectiveness of his library.

The time allotted to this paper today does not permit presentation of all data and findings of our study. These will be available in the three reports of the study. Nor does time permit mention here even briefly of the findings of all five approaches followed. For this reason we shall omit the discussion of approaches one and two and concentrate on the remaining three—our efforts with correlation analysis, with certain management techniques, and our experiment adapting classical 'utility analysis' to the library mission, objectives, services and operations.

Correlations

A number of studies have been performed by other investigators in which numerous data have been collected on various aspects of federal libraries. Collection size and composition, staff size, operations and services performed, and population of clients are among the aspects represented.

One of the first tasks of our study was the identification, collection and analysis of these data to explore possible relationships between library statistics and efficiency and effectiveness. Although we shall not show the data in this paper, they are available for examination. These data are supplemented by additional data gathered by a team of our investigators on the occasions of a series of visits to selected Army Technical Libraries.

The correlation process is helpful in studying the development of criteria and subsequent standards. Two applications of correlation analysis will be discussed here:

I Correlations by which to identify criteria for possible development of standards.

II Correlations by which to identify certain operations which have a significant influence on the probability of occurrence of some of the events (one or more) essential to fulfilling the library mission.

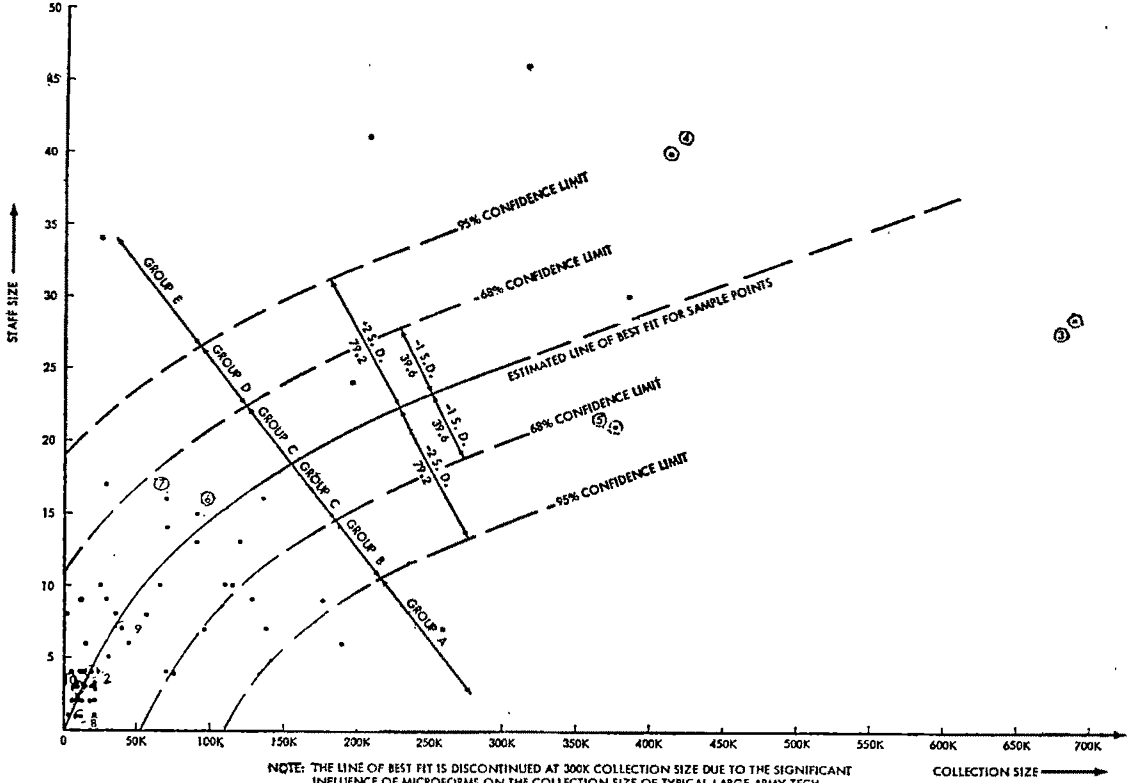
Application I requires the correlation of a variety of data classes where the relationships one with the other may be strong or meaningful. For example, we would suspect that there should be a correlation between the number of books and documents received by a library in a week and the weekly cost of receiving. If a high correlation is found to exist within and/or among libraries, we could deduce that the libraries do generally conform to some unwritten standard for unit cost of receiving books and documents. In this way we can recognize areas where the development and enforcement of standards would be realistic in the sense that there is a high probability that tight, attainable, and enforceable standards can be developed. Among the correlations tried in Phase II, significant correlations were found among the following classes of data:

(*a*) The number of items acquired per week and:
  1 The cost of acquisitions per week.
  2 The number of titles catalogued per week.
  3 The cost of cataloguing per week.
  4 The cost of preparation and maintenance of materials per week.
(*b*) The number of documents and periodicals acquired per user per week and the items circulated upon request per user per week.
(*c*) The number of titles catalogued per week and the cost of cataloguing per week.
(*d*) The circulation of items upon request per week and:
  1 The cost of circulation upon request per week.
  2 The number of documents, reports, theses and bound volumes per user.
(*e*) The circulation of items upon request per user per week and the number of items circulated by predetermined circulation per week.
(*f*) The number of items circulated by predermined routing per week and:
  1 The cost of predetermined routing per week.
  2 The number of subscriptions in the collection per user.
(*g*) Total circulation of items per user per week and the number of documents, reports, theses, bound volumes and subscriptions per user.
(*h*) The number of reference searches per week and the cost of reference searches per week.
(*i*) The number of bibliographic citations compiled per week and the cost to compile these references per week.
(*j*) The number of documents, technical reports and books in the collection and the staff size.

Where significant and meaningful correlations are found, further investigation can be made to develop standards. For example, Figure 1 is a scatter diagram of staff size *v.* collection size. A line of best fit can be computed and deviations from the line can be measured by some arbitrary scale. If the libraries (points) are found to be distributed normally about the line of best fit, then the line can describe a standard which represents the locus of the mean, median and mode libraries. This standard is simply a point from which to measure the deviation of libraries from a normal or average condition. Figure 2 describes the distribution about the line of best fit. The bell-shaped curve (dashed line) is characteristic of a normal population. If, for example, the deviations of the libraries had distributed themselves in a double-humped curve, it may be that there exist two types of libraries which should be measured by different standards.

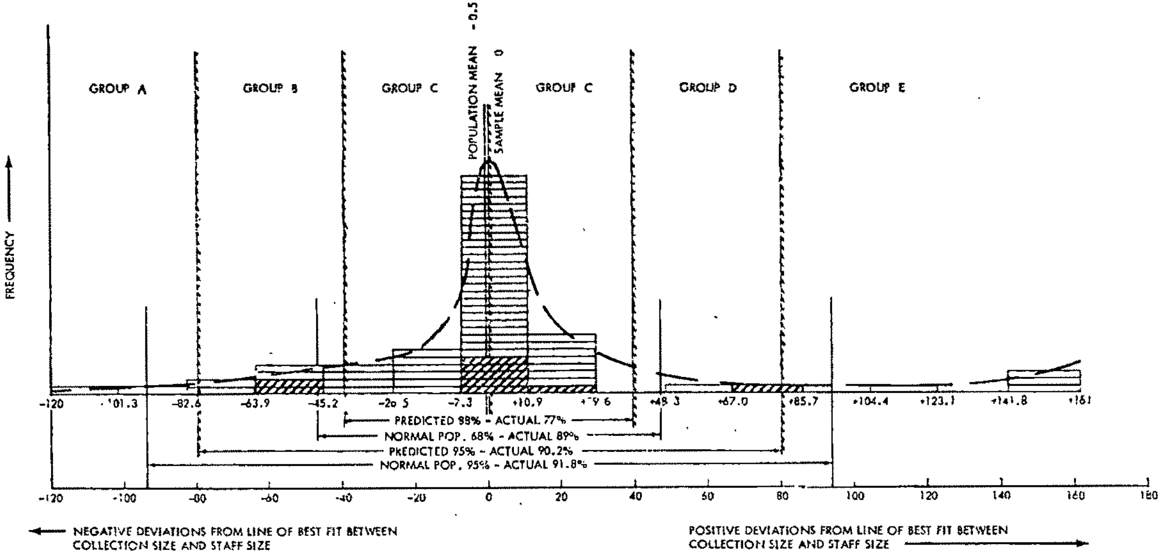
The libraries in Group E in Figure 1 have high staff sizes in relation to collection size. This extreme deviation from the norm should be accounted for since it may indicate inefficiency in receiving, maintaining and disseminating information. The deviation may be justified, however, if there are large amounts of inter-library loans, a large number of trainees on the staff, or high effectiveness in selecting, indexing and disseminating information.

The standards which may be developed by correlation analysis are simply



NOTE: THE LINE OF BEST FIT IS DISCONTINUED AT 300K COLLECTION SIZE DUE TO THE SIGNIFICANT INFLUENCE OF MICROFORMS ON THE COLLECTION SIZE OF TYPICAL LARGE ARMY TECHNICAL LIBRARIES AND DUE TO INABILITY TO DEFINE MEANINGFUL CONFIDENCE LIMITS FOR THE SMALL NUMBER OF LARGE LIBRARIES.

FIGURE 1. CORRELATION OF STAFF SIZE VS. NUMBER OF DOCUMENTS, TECHNICAL REPORTS & BOOKS IN COLLECTION



NOTE: LARGE LIBRARIES (OVER 300K COLLECTION SIZE) CANNOT BE JUDGED ACCORDING TO THEIR DEVIATION FROM THE MEAN OF THE POPULATION DESCRIBED BY THIS HISTOGRAM.

FIGURE 2. POPULATION HISTOGRAM OF VARIATIONS FROM SAMPLES ESTIMATED LINE OF BEST FIT

tools to measure the deviation from the norm. Such standards are potentially useful for controlling efficiency and effectiveness of libraries.

Application II involves correlations between the probability of occurrence of certain essential events and the frequency or magnitude of certain operations required in producing that event. For example, let us consider the case in which we wish to determine the influence of depth of indexing of documents, in collections of various sizes, upon the probability of locating one or more documents (this could be three or more, five or more, ten or more, etc.) in response to a query from a client. Let us assume, furthermore, that the client's question is non-specific and that he will not know when he has the complete answer to his question (we refer later to this type question as equivocal-equivocal). The situation may be depicted by constructing a three-dimensional graph (Figure 3) utilizing data from actual searches to determine $Pj3$, Xij and Yij, where:

$Pj3$ is the probability of finding three or more documents relevant to the client's request at a j library.

Xij is the total number of documents in all subject classes searched, e.g. mathematics, chemistry, etc., at library j for query i.

$\bar{Y}ij$ is average number of index terms per candidate document in the relevant subject classes at library j for query i.

It now becomes possible to gather data based on document-finding results for a population of queries, at a number of different libraries, where the mean number of index terms used on documents recalled as well as the number of relevant documents in the given subject classes can be determined. From this data equations for the probability of finding some number of documents can be constructed. For example, the probability of finding three or more documents may be some function of Xij, $\bar{Y}ij$ and tij, i.e.:

$$Pj3 = f[(Xij), (\bar{Y}ij), (tij)]$$

Here the time factor t (time in search) has been added as the third member of the equation and additional factors could be inserted. The variable of search ability will be considered constant for qualified reference librarians. However, a proficiency test could be administered to level this factor. The subscripts i and j refer to a particular query in the i family of queries at a particular library in the j family of libraries. In a group of ten libraries, $j = 1, 2, 3 \ldots 10$, and an individual library, say, has one hundred queries with Xij, $\bar{Y}ij$ and tij known; these queries are $i = 1, 2, 3 \ldots 100$. The first query at the first library will have specific Xij, $\bar{Y}ij$ and tij values of, say, $X11 = 1{,}000$ documents, $\bar{Y}11 = 3$ terms and $t11 = 1$ hour.

Having developed this probability situation the following proposition can be posed to the library administrator:

If you wish to achieve a probability value P (perhaps 95 per cent) that you will be able to retrieve three or more documents in response to clients' needs in specified subject fields, when your collection size in that subject field is a certain number of documents, and time t can be spent searching, it is necessary that these documents in your collection be indexed to an average depth $\bar{Y}$. If the document collection size is altered, or if t is altered, $\bar{Y}$ will change. It

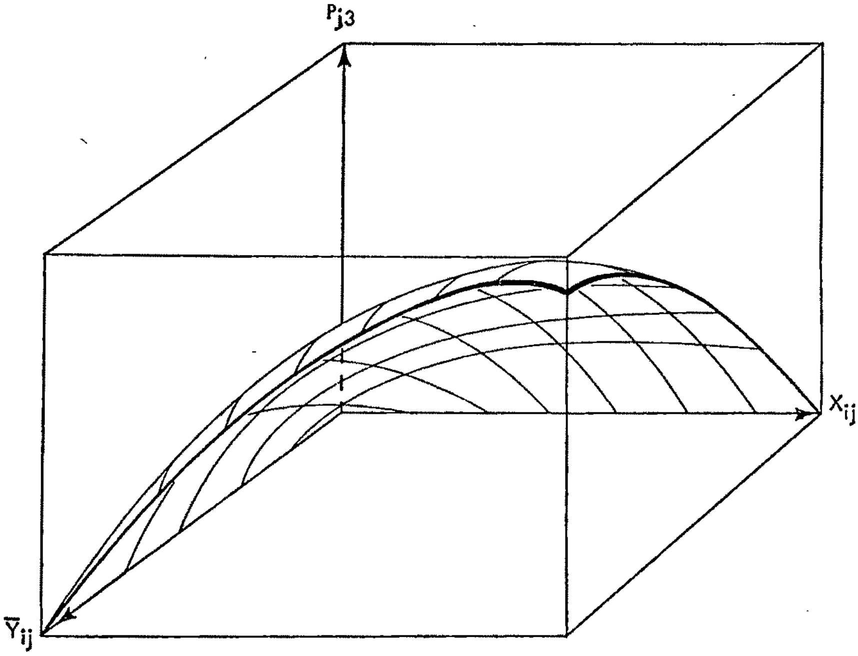


FIG. 3.

will be possible to prepare families of graphs for *Pj* values for retrieving increasing numbers of documents: one or more; two or more; three or more, etc.

Having determined the depth of number of index terms for a set of constants, the library authority can now set a 'standard' for indexing depth. While these 'standard' conditions exist, meeting them will ensure that the library's effectiveness in responding to clients' search needs of that type has the probability value chosen with a certain predetermined risk of error. Once this number of index terms is determined and set by authority as the standard number of index terms for that particular subject classification in that particular collection, then adherence to that standard should achieve the probability of effectiveness indicated by the study.

Management Techniques

Our fourth approach was based on consideration of management techniques. The initial phases of our work identified a large number of such techniques—too large a number to deal with easily. To reduce the number to a size we could manipulate easily we analysed the group by a 'paired comparison' method. Three qualified management consultants on our staff were supplied with definitions of all library functions involved and with a glossary of the management techniques which had been compiled in our phase I work. All were instructed identically as to the methods they were to use in making the comparisons.

TECHNIQUES	COMPARISON FACTORS	II	XII	XI	XXX	XXII	XV	XVI	XX	III	XXVII				RATING	RANK	REFERENCES
II Cost Effectiveness	Indicator of Efficiency		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				9	1	155, 20*,141
	Indicator of Effectiveness		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				9	1	
	Controller of Performance		No	No	No	Yes	Yes	Yes	No	Yes	Yes				5	5	
XII Standardization	Indicator of Efficiency	No		No	No	No	No	No	No	No	No				0	-	355*, 58*, 74*, 11*, 269*, 296*, 382*, 481*, 760*, 766*
	Indicator of Effectiveness	No		No	No	No	No	No	No	No	No				0	-	
	Controller of Performance	Yes		Yes	Yes	Yes	Yes	Yes	No	Yes	Yes				8	2	
XI Methods Study	Indicator of Efficiency	No	Yes		No	No	No	No	Yes	Yes	Yes				4	6	65*, 228 ,618, 760*, 764
	Indicator of Effectiveness	No	No		No	No	No	No	No	No	No				0	-	
	Controller of Performance	Yes	No		Yes	Yes	Yes	Yes	No	No	Yes				6	3.5	
XXX Motion & Time Study	Indicator of Efficiency	↕	Yes	Yes		No	Yes		Yes	Yes	Yes				6	4	761, 760*, 32, 315, 255*
	Indicator of Effectiveness	No	No	No		No	No	No	No	No	No				0	-	
	Controller of Performance	No	No	No		No	No	No	No	No	No				0	-	
XXII Data Processing Techniques Evaluation	Indicator of Efficiency	↕	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes				8	2	230, 766*
	Indicator of Effectiveness	│	No	No	No		No	No	No	No	No				0	-	
	Controller of Performance	No	No	No	Yes		No	No	No	No	No				1	6	
XV Work Sampling	Indicator of Efficiency	↕	Yes	Yes	↕	No			Yes	Yes	Yes				5	5	761, 32, 315, 465*, 760*, 587, 63*
	Indicator of Effectiveness	No	No	No	No	No		No	No	No	No				0	-	
	Controller of Performance	No	No	No	No	No		No	No	No	No				0	-	
XVI Group Attainment Program	Indicator of Efficiency	No	Yes	Yes	Yes	No	Yes		Yes	Yes	Yes				7	3	251
	Indicator of Effectiveness	No	No	No	No	No	No		No	No	No				0	-	
	Controller of Performance	No	No	No	No	No	No		No	No	No				0	-	
XX Budgeting	Indicator of Efficiency	↕	No	No	No	No	No	No		No	No				0	-	226, 77, 136, 111, 63*, 338, 20*, 231, 274*
	Indicator of Effectiveness	No	No	No	No	No	No	No		No	No				0	-	
	Controller of Performance	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes				9	1	
III Cost Accounting	Indicator of Efficiency	↕	Yes	No	No	No	No	No	Yes		Yes				3	7	311, 231, 226, 111, 62*, 63*, 367, 760*
	Indicator of Effectiveness	No	No	No	No	No	No	No	No		No				0	-	
	Controller of Performance	No	No	Yes	Yes	Yes	Yes	Yes	No		Yes				6	3.5	
XXVII Research	Indicator of Efficiency	↕	Yes	No	No	No	No	No	Yes	No					2	8	71*, 31*, 211*, 432*
	Indicator of Effectiveness	│	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes					7	2	
	Controller of Performance	No	No	No	No	No	No	No	No	No					0	-	
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*Previously Used or Proposed For Library Applications

FIG. 4. *Circulation Service.*

The paired comparison method employed a type chart for each individual library function. Figure 4 is an example which illustrates the method used. This example illustrates the selection of management techniques for evaluating 'circulation services'. All management techniques which we had identified as possibly useful for all library functions were subjected to such analyses. You will note that the techniques listed by name in the left-hand column have a roman numeral appended. These are identical to the numerals in the top horizontal row. Thus each technique is evaluated against all others listed for that particular library function. Each is evaluated as (1) Indicator of efficiency, (2) Indicator of effectiveness, and (3) Controller of performance. Arrows indicate that the technique in the vertical column is or can be a sub-technique of the more generic technique represented in the top horizontal row. References shown pertain to documents listed in our phase I report.

After all judgments were performed, ratings and ranks were determined as shown in the column on the right. The highest ranked techniques for each library function on each comparison factor are summarized in Figures 5 and 6. Of the various techniques only three were chosen to be utilized in our work: GAP (Group Attainment Program), Cost-Effectiveness Analysis, and PPBS (Planning-Programming-Budgeting System). Other techniques are used informally in the work, of course, such as systems analysis, utility analysis, probability methods, correlation methods, charting, cost-accounting, and so on.

For our present purposes, only one example will be taken—Cost-Effectiveness Analysis. Moreover, for the purposes of this presentation, this technique will be applied to only a single service—search service.

In order to make a cost-effectiveness analysis of services possible, it is necessary:

1 to define each significant service;
2 to define all significant activities and operations;
3 to provide meaningful cost data for each activity and operation;
4 to provide meaningful effectiveness data for each operation and service.

The concept of search services itself can become very generalized and defeat the purpose of analysis unless attention is focused on a fairly specific case. Early in our work we arranged search services into four categories:

I unequivocal-unequivocal;
II equivocal-unequivocal;
III equivocal-equivocal;
IV unequivocal-equivocal.

In case I, for example, the client specifically states a specific need. In case II he has a specific need, but because of lack of information must state his need ambiguously; however, he will specifically know he has what he wants when he receives it. In case III he must state his need ambiguously due to the breadth or generality of his need and he will not know whether he has received everything which pertains to the need. In case IV he can specifically state his need, but he will not know if the service fulfils it. Each case must be divided into three sub-cases: (*a*) the librarian alone makes the search, (*b*) the librarian and client make the search co-operatively, and (*c*) the user makes the search alone.

LIBRARY FUNCTION (High Priority)	COMPARISON FACTORS	MANAGEMENT TECHNIQUES													REFERENCES
		II Cost-Effectiveness	XX Budgeting	XXIV Quality Control	XXIII Cybernetics	XVI G. A. P.	XII Standard-ization	XIII Standard Data	XI Methods Study	IV Utility Analysis	XIV Performance Evaluation	V P. P. B. S.	XXVI Organization Analysis		
Information Retrieval Service	Indicator of Efficiency	1													155, 14, 56, 112, 125, 86, 141,
	Indicator of Effectiveness	1													303, 336, 89
	Controller of Performance				1										518, 521, 755
Translation Service	Indicator of Efficiency	1													155, 20, 141
	Indicator of Effectiveness	1													
	Controller of Performance			1											583, 588, 760
Bibliographic Service	Indicator of Efficiency	1													135, 20, 141
	Indicator of Effectiveness	1													
	Controller of Performance		1												226, 77, 136, 111, 63, 338, 274
Circulation Services	Indicator of Efficiency	1													155, 20, 141
	Indicator of Effectiveness	1													
	Controller of Performance		1												226, 77, 136, 111, 63, 338, 274
Reference Services	Indicator of Efficiency	1													155, 20, 141
	Indicator of Effectiveness	1													
	Controller of Performance		1												226, 77, 136, 111, 63, 338, 274
Library Mission and Orientation to Organization	Indicator of Efficiency												1		394, 79, 206
	Indicator of Effectiveness												1		146, 126, 204, 227
	Controller of Performance											1			437, 317
Staff Utilization	Indicator of Efficiency					1									251
	Indicator of Effectiveness									1					394
	Controller of Performance							1							760, 761, 32, 313, 41
Cataloging and Classifying	Indicator of Efficiency					1									
	Indicator of Effectiveness N/A														
	Controller of Performance						1								481, 58, 74, 242, 11, 269, 382, 760, 296
Abstracting	Indicator of Efficiency					1									251
	Indicator of Effectiveness			1											
	Controller of Performance						1								
Indexing	Indicator of Efficiency					1									251
	Indicator of Effectiveness N/A														
	Controller of Performance							1							481, 58, 74, 242, 11, 269, 296, 382, 760
Acquisitions and Accessions	Indicator of Efficiency					1									251
	Indicator of Effectiveness N/A														
	Controller of Performance								1						618, 760, 764
Reference Work	Indicator of Efficiency					1									251
	Indicator of Effectiveness N/A														
	Controller of Performance								1						618, 760, 764
Preparation and Maintenance of Library Materials	Indicator of Efficiency					1									251
	Indicator of Effectiveness N/A														
	Controller of Performance								1						19, 228, 618, 760, 754
Budget-Allocation for Services and Operations	Indicator of Efficiency											1			652, 115, 231
	Indicator of Effectiveness	1													20, 155, 184
	Controller of Performance											1			437, 317, 226, 111, 338, 274, 136
Staff Salary	Indicator of Efficiency										1				462, 80, 324, 162, 120
	Indicator of Effectiveness										1				289, 760
	Controller of Performance N/A														
Contents Composition and Extent	Indicator of Efficiency N/A														
	Indicator of Effectiveness									1					184, 183, 763, 372
	Controller of Performance		1												226, 77, 136, 111, 231
		A	O	O	O	O	O	O	A	A	A	O	A		

FIG. 5. *Tentative Tools Chart.*

LIBRARY FUNCTION (Low Priority)	COMPARISON FACTORS	MANAGEMENT TECHNIQUES														REFERENCES
		V P. P. B. S.	XIV Performance Evaluation	XXVII Research	XVII Human Relations	II Cost-Effectiveness	XII Standard-ization	XXIV Quality Control	XXV Plant Layout Analysis	X Layout Chart	XXXIII Cybernetics					
Contract Performance	Indicator of Efficiency	1														652, 311, 231, 62
	Indicator of Effectiveness		1													80, 462, 162, 120
	Controller of Performance	1														439, 294, 371, 436
Services Orientation to Various Types of Clientele	Indicator of Efficiency			1												24, 80, 386
	Indicator of Effectiveness			1												71, 42, 396, 397, 421
	Controller of Performance				1											765, 133
Research in Library Operations	Indicator of Efficiency					1										71, 68, 92, 240, 31, 211, 421
	Indicator of Effectiveness					1										
	Controller of Performance	1														437, 317
Incentive Programs	Indicator of Efficiency					1										155, 63, 338, 274
	Indicator of Effectiveness					1										108, 765, 264
	Controller of Performance N/A															
Editorial Assistance	Indicator of Efficiency		1													462, 111, 63, 338, 274
	Indicator of Effectiveness		1													120, 289
	Controller of Performance							1								588, 760
Budget-Allocation for Materials	Indicator of Efficiency					1										155, 111, 311
	Indicator of Effectiveness					1										141, 184, 763
	Controller of Performance	1														231, 274, 136
Space and Size Arrangement	Indicator of Efficiency								1							19, 263, 760
	Indicator of Effectiveness								1							762, 279
	Controller of Performance									1						761
Geographical Location	Indicator of Efficiency					1										155, 760
	Indicator of Effectiveness					1										260
	Controller of Performance N/A															
Automation Application to Operational Procedures	Indicator of Efficiency					1										155, 111, 311, 425, 56, 200, 112, 51
	Indicator of Effectiveness					1										141, 49, 23
	Controller of Performance										1					521
Staff Professional Activities	Indicator of Efficiency					1										226
	Indicator of Effectiveness					1										428, 344
	Controller of Performance						1									583, 224, 233, 382, 400
Clientele and Staff Training Programs	Indicator of Efficiency					1										155, 136
	Indicator of Effectiveness				1											24, 47, 428
	Controller of Performance						1									74,233,296,381,90
Equipment Cost Type and Amount	Indicator of Efficiency					1										155, 111, 311
	Indicator of Effectiveness					1										141, 184,
	Controller of Performance	1														63, 136, 231, 274
	Indicator of Efficiency															
	Indicator of Effectiveness															
	Controller of Performance															
	Indicator of Efficiency															
	Indicator of Effectiveness															
	Controller of Performance															
	Indicator of Efficiency															
	Indicator of Effectiveness															
	Controller of Performance															
	Indicator of Efficiency															
	Indicator of Effectiveness															
	Controller of Performance															
		O	A	:A	A	A	O	O	A	A	O					

FIG. 6. *Tentative Tools Chart.*

By selecting case IIIa, the situation is made sufficiently specific to lend itself to the cost-effectiveness analysis.

In order to apply the technique it is necessary, therefore, to simulate real world situations as closely as possible. Such a simulation has been attempted in a generalized model of search services in a typical Army Technical Library as shown in Figure 7, and the more specific model of case IIIa in Figure 8.

Each service chain has one or more entry points. All entries from event 1 are origins of library service needs. All entries from other events are continuations of needs which have required previous library services. In actual use, event blocks critical to service effectiveness are assigned probabilities that the event will occur. These probabilities are based upon past experience of the percentage of needs met using statistical and/or subjective analysis or by statistical sampling. Each activity is represented by the connecting line between events. Activities which accrue signficant costs are assigned standard cost data. These standard cost data may be derived from past experience or may be generated by work sampling, motion and time study, GAP and cost accounting techniques. The standard cost data are expressed as average unit cost per need or as expected cost per hundred needs or some similar representation of cost standardization.

Measures of effectiveness may be derived from the probabilities that events will occur when a number of needs are processed. Certain event blocks separate and identify factors which influence effectiveness. For example, in Figure 7, event 3 (the librarian begins a search), two possible reasons which could explain why a reference librarian would not process a need further are: (*a*) the need is not within the scope of the library's mission, and (*b*) the priority of other tasks. Indicators of the per cent cause of failure to accomplish the event represented by sub-probabilities will help identify the reason for low probabilities of effectiveness. These causal identifiers can indicate criteria for effectiveness. Effectiveness causal factors may be any identifiers which reflect a responsiveness of effectiveness to the extent of the factor present.

Another effectiveness causal factor is the direct labour operation preceding each event block. For example, in Figure 7, event 4 (some candidate documents are identified), is preceded by the activity of the librarian conducting a reference search. This activity lying between event 3 and event 4 is called activity 3–4. The effectiveness probability of event 4 depends upon the performance of activity 3–4. Event 4, then, is a function of activity 3–4. The effectiveness of activity 3–4 can be measured to some extent by the probability of event 4 occurring. Conversely, the occurrence of event 4 is partially dependent on the time, effort and facilities allocated in activity 3–4. Therefore, performance of activity 3–4 may be recognized as a causal factor influencing the effectiveness probability of event 4. The standard unit cost per need of activity 3–4 may show a correlation with the effectiveness probability of event 4. Where high correlation is found to exist, the standard unit cost of activities becomes a causal factor of effectiveness.

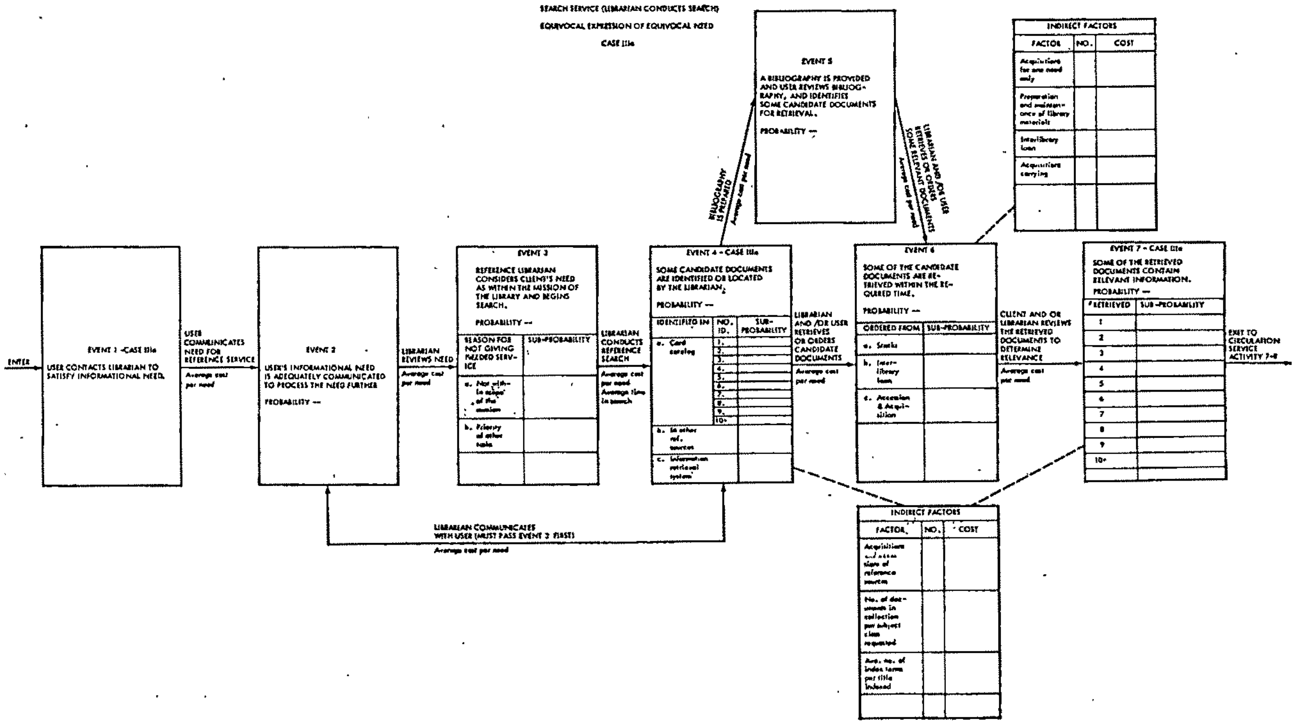
Another effectiveness causal factor is the cost of indirect library functions. These functions may contribute to effectiveness in the same manner as direct cost activities. Indirect costs to services are those which contribute to long-range effectiveness, such as costs of acquisitions and accessions, preparation and maintenance of library material, cataloguing, classifying, indexing, and setting up of systems for information retrieval and for selective dissemination of information. These costs must be pro-rated over their effective use period. The costs assigned in the indirect factors blocks may be based on costs pro-rated per user, per hundred users, per unit time, or other units. As in the case of direct activity performance and standard unit costs, indirect function performance and standard unit costs may show a correlation with effectiveness probabilities. Where high correlations are found to exist, standard unit cost or extent of indirect functions can become a criterion of effectiveness.

The total cost of a service can be computed by summing the direct and indirect unit costs. The total effectiveness of a service can be determined by the number of needs which meet the objectives of the service relative to the number of needs entering the service. Along any chain of events and activities, effectiveness E can be computed by the product of effectiveness probabilities or by the formula:

$$E = \frac{\text{No. of needs processed through services' final objective} \times 100 \text{ per cent}}{\text{No. of entry needs}}$$

The intrinsic effectiveness of a service to a user may not necessarily be represented by event probabilities. The probabilities are, however, indicators of the effectiveness of library expenditures in actuating events essential to meeting the services objective. The effectiveness of search service, for example, depends on meeting objectives of the service. The objectives can be represented generally by the possible events in a service chain. For example, one objective of reference service or search service may be simply to identify some candidate documents for an informational need. The effectiveness of this service in meeting this objective can be measured by the product of probabilities of communication of needs, of the librarian beginning a search and of the librarian identifying some candidate documents. Another objective of search service may be to determine, perhaps by examination, the documents relevant to a given informational need. The effectiveness of the service in meeting this objective may be measured by the product of the probabilities of communication of needs, of the librarian beginning a search, of the librarian identifying some candidate documents, of the candidate documents being retrieved and of the candidate documents containing some relevant information. The effectiveness of the library in meeting the clients' needs is predicated on the goals and objectives of each service and ultimately on the library mission.

Before a meaningful measure of effectiveness to the user can be derived, therefore, it is necessary to determine the service or services needed by the user. For example, one class of users may communicate a need for information on a given subject. To meet this need it may be necessary to provide first a search service (Figure 7) through events 1, 2, 3, 4, 6 and 7, and then a circulation service. After the client receives the documents, the services are completed. The completion of each event represents progressing in steps to a final objective. The overall effectiveness probability of meeting this objective for a population of users is the product of the probabilities of the events involved. Other measures of effectiveness of the service in meeting the mission of the library



SEARCH SERVICE (LIBRARIAN CONDUCTS SEARCH)

EQUIVOCAL EXPRESSION OF EQUIVOCAL NEED

CASE IIIe

ENTER
EVENT 1 -CASE IIIe
USER CONTACTS LIBRARIAN TO SATISFY INFORMATIONAL NEED.
USER COMMUNICATES NEED FOR REFERENCE SERVICE
Average cost per need
EVENT 2
USER'S INFORMATIONAL NEED IS ADEQUATELY COMMUNICATED TO PROCESS THE NEED FURTHER
PROBABILITY —
LIBRARIAN REVIEWS NEED
Average cost per need
EVENT 3
REFERENCE LIBRARIAN CONSIDERS CLIENT'S NEED AS WITHIN THE MISSION OF THE LIBRARY AND BEGINS SEARCH.
PROBABILITY —
REASON FOR NOT GIVING NEEDED SERVICE
SUB-PROBABILITY
a. Not within scope of the mission
b. Priority of other tasks
LIBRARIAN CONDUCTS REFERENCE SEARCH
Average cost per need
Average time in search
EVENT 4 - CASE IIIe
SOME CANDIDATE DOCUMENTS ARE IDENTIFIED OR LOCATED BY THE LIBRARIAN.
PROBABILITY —
IDENTIFIED IN
NO. ID.
SUB-PROBABILITY
a. Card catalog
1.
2.
3.
4.
5.
6.
7.
8.
9.
10+
b. In other ref. sources
c. Information retrieval system
LIBRARIAN COMMUNICATES WITH USER (MUST PASS EVENT 2 FIRST)
Average cost per need
BIBLIOGRAPHY IS PREPARED
Average cost per need
EVENT 5
A BIBLIOGRAPHY IS PROVIDED AND USER REVIEWS BIBLIOGRAPHY, AND IDENTIFIES SOME CANDIDATE DOCUMENTS FOR RETRIEVAL.
PROBABILITY —
LIBRARIAN AND /OR USER RETRIEVES OR ORDERS SOME RELEVANT DOCUMENTS
Average cost per need
LIBRARIAN AND /OR USER RETRIEVES OR ORDERS CANDIDATE DOCUMENTS
Average cost per need
EVENT 6
SOME OF THE CANDIDATE DOCUMENTS ARE RETRIEVED WITHIN THE REQUIRED TIME.
PROBABILITY —
ORDERED FROM
SUB-PROBABILITY
a. Stacks
b. Inter-library loan
c. Accession & Acquisition
INDIRECT FACTORS
FACTOR
NO.
COST
Acquisitions for one need only
Preparation and maintenance of library materials
Interlibrary loan
Acquisitions carrying
CLIENT AND OR LIBRARIAN REVIEWS THE RETRIEVED DOCUMENTS TO DETERMINE RELEVANCE
Average cost per need
EVENT 7 - CASE IIIe
SOME OF THE RETRIEVED DOCUMENTS CONTAIN RELEVANT INFORMATION.
PROBABILITY —
# RETRIEVED
SUB-PROBABILITY
1
2
3
4
5
6
7
8
9
10+
EXIT TO CIRCULATION SERVICE ACTIVITY 7-8
INDIRECT FACTORS
FACTOR,
NO.
COST
Acquisitions and accessions of reference sources
No. of documents in collection per subject class requested
Ave. no. of index terms per title indexed

FIG. 8

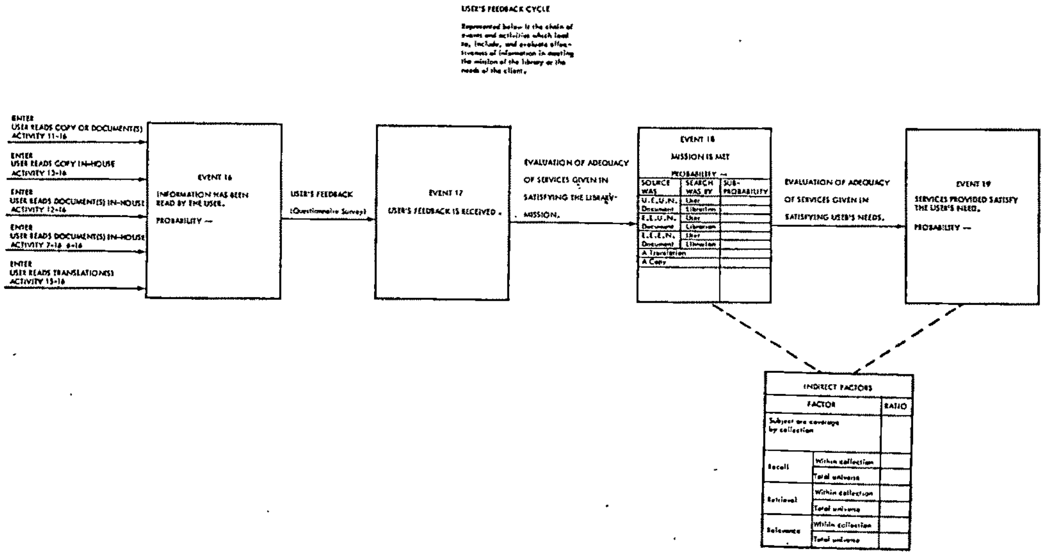

USER'S FEEDBACK CYCLE
Represented below is the chain of events and activities which lead to, include, and evaluate effectiveness of information in meeting the mission of the library or the needs of the client.
ENTER
USER READS COPY OR DOCUMENT(S)
ACTIVITY 11-16
ENTER
USER READS COPY IN-HOUSE
ACTIVITY 13-16
ENTER
USER READS DOCUMENT(S) IN-HOUSE
ACTIVITY 12-16
ENTER
USER READS DOCUMENT(S) IN-HOUSE
ACTIVITY 7-16 6-16
ENTER
USER READS TRANSLATION(S)
ACTIVITY 15-16
EVENT 16
INFORMATION HAS BEEN READ BY THE USER.
PROBABILITY —
USER'S FEEDBACK
(Questionnaire Survey)
EVENT 17
USER'S FEEDBACK IS RECEIVED.
EVALUATION OF ADEQUACY OF SERVICES GIVEN IN SATISFYING THE LIBRARY MISSION.
EVENT 18
MISSION IS MET
PROBABILITY —
SOURCE WAS
SEARCH WAS BY
SUB-PROBABILITY
U.E.U.N. Document
User
Librarian
E.E.U.N. Document
User
Librarian
E.E.E.N. Document
User
Librarian
A Translation
A Copy
EVALUATION OF ADEQUACY OF SERVICES GIVEN IN SATISFYING USER'S NEEDS.
EVENT 19
SERVICES PROVIDED SATISFY THE USER'S NEED.
PROBABILITY —
INDIRECT FACTORS
FACTOR
RATIO
Subject area coverage by collection
Recall
Within collection
Total universe
Retrieval
Within collection
Total universe
Relevance
Within collection
Total universe

FIG. 9.

or the client's needs can be determined from user feedback (Figure 9). If the user reads the documents, event 16 occurs, so that the next activity would be user feedback. The feedback would permit: (1) evaluating the adequacy of the source(s) in meeting the mission of the library (activity 17 and 18), and (2) evaluating the adequacy of the source(s) in meeting the client's needs (activity 17, 18 and 19).

The measure of mission-related effectiveness is not necessarily a measure of the total effectiveness to the users of the services or to the parent organization. The measure of mission-related effectiveness will more closely approximate the measure of effectiveness to the user or parent organization as the goals, objectives and mission of the library approach the goals and objectives of the user and support the mission of the parent organization. Therefore, the importance of well-formulated library mission, goals and objectives in deriving a meaningful measure of effectiveness of the library cannot be over-emphasized. In order to explain further the applicability of this technique to real world situations, we refer again to the four cases of searches designated earlier (unequivocal-unequivocal, equivocal-equivocal, etc.) and the three sub-cases of each.

Each of the twelve cases will be handled differently in computing costs and effectiveness. The probable paths taken in several cases are marked in Figure 7. An example of an equivocally expressed, equivocal need, case IIIa, follows.

CASE IIIA	Client contacts a reference librarian seeking a bibliography on a given subject. This case is an equivocally expressed equivocal need. The following activities and events ensue (Figure 8).
Activity 1–2	The client communicates his need for information on the effect of contaminants on ruby lasers.
Event 2	The client's need is adequately communicated (understood) by the librarian to process the need further.
Activity 2–3	The reference librarian reviews the client's need in order to determine if service will be given.
Event 3	The reference librarian considers the client's need as within the mission of the library and as having significant priority to begin a search.
Activity 3–4	The librarian conducts a search.
Event 4	Some candidate documents are identified by the librarian. At this point (event 4) a client's request for a bibliography may begin activity 4–5. However, the client may not require a bibliography, but instead may ask for some of the candidate documents. If this is the case activity 4–6 begins.
Activity 4–5	(alternate). A bibliography is prepared.
Event 5	(alternate). A bibliography is provided and the user reviews the listings.

Activity 5–6	(alternate). The user orders and the librarian retrieves some of the documents listed in the bibliography.
Activity 4–6	(alternate). The librarian retrieves some of the candidate documents.
Event 6	Some of the candidate documents are retrieved within the required time.
Activity 6–7	The client reviews the documents to determine relevance.
Event 7	Some of the documents are relevant. Event 7 ends the search service. At this point the client may request circulation service and exit to the proper event.

If one hundred similar needs are processed and all needs are met, the effectiveness probabilities of all events would be 100 per cent. If, for example, only seventy needs passed event 3 out of one hundred which passed event 2, then the effectiveness probability of event 3 would be 70 per cent. This may indicate that the mission statement should be revised to encompass more of the client's needs or that additional reference librarians are needed because many needs could not be met due to priority of other tasks.

Contamination of the measurements of effectiveness can arise from: (1) poorly developed library missions statements which are not clear or compatible with the user's departmental missions, (2) poor interpretation of user feedback, and (3) inadequacy of feedback to express the true utility of the information in meeting the objectives of the user.

In summary, and in spite of the errors inherent in the measurements of effectiveness, this systematic approach is potentially useful in resolving the probabilities that the services will meet the needs of its users to the extent that criteria of cost-effectiveness can be established objectively.

Mission Approach and Utility Analysis

The fifth and final approach used in our study was based on the idea of formalizing in the mind of the librarian that all operations performed in his library, and all services his library produces, serve the goals and objectives which either he or his superiors have set as implementing the overall mission of his library. It provides the format and procedures which the librarian can use in formalizing (1) his library's mission statement, (2) the goals and objectives which give form and substance to that mission, (3) the particular activities or services his library should produce to implement those goals and objectives, and finally (4) those operations which he and his staff must perform to produce those services or activities.

In applying this method it is required that the mission statement be provided first. It can, for example, be prepared by the director of the research laboratory served. It is desirable, however, for the librarian to review the statement to ensure it is in terms he can understand. The goals and objectives statement should be prepared jointly by the higher authority and the librarian. The identification of the particular services and products to be produced should be performed by the librarian, because he is by training and experience best fitted to determine which services and products producible by a library fill the specifications of the goals and objectives. When these three levels of statements have been decided upon, the librarian is ready to test this particular approach.

The librarian, from the background of his librarianship and knowledge of the overall situation, must then assign weights or values to the various services and products of his organization. These can be arbitrary numbers which have little or no meaning *per se*, but which by comparison, each with the others, give the relative importance of the services and products as they support the goals and objectives. For purposes of simplicity in this exercise, the sum of these arbitrary values is equated to the total 'utils' of the library, as will be discussed later.

This type of data was sought from the libraries visited during the Phase II data gathering survey, and a matrix was developed to facilitate a test of the librarians' ability to assign relative values for operations and services. This type of data is expected to reflect the relative values of operational outputs toward providing given services and the relative values of services in supporting the mission of the libraries.

Some of the librarians who were asked to provide these data were not responsive. This poor response indicates that: (1) the values sought were not clearly communicated or understood, (2) the librarians are often not able to quantify the values of operations in supporting services* or values of services in supporting missions.

From the data submitted it was apparent that all librarians do not assign the same values to given operations and services. However, there was some general agreement in the rank order of values assigned. This rank order is from highest to lowest of five services: reference search, circulation, bibliographies, publications, translations. The observations are indicative that even though libraries have different missions, goals and objectives, the relative values of operations and services do not diverge completely among the Army Technical Libraries, although values can be expected to be affected by missions and the kinds and degrees of operations performed.

In evaluating the responses received during the data collection effort it was deduced that some librarians do have the ability to assess the comparative values of their services and operations. However, it is considered necessary to develop the concept further in order that more meaningful and complete value data may be collected to determine and validate criteria from this type of data.

In order to pursue these concepts somewhat further, it was decided to try to adapt the principles of classical utility analysis to the library situation. In the following discussion it must be remembered that we are modifying utility analysis quite freely and that some of the terms should be interpreted broadly. For example, even the term 'utility' should not be regarded too strictly, for we are not dealing only with usefulness or numbers of times a thing is used. Rather we are trying to adapt a technique to a function to which it is difficult to assign quantitative parameters.

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* For purpose of this discussion the term 'services' also includes 'products'.

The procedures outlined here are intended for investigating the applicability of classical utility criteria for measuring the value of commodities (services and products), and for making determinations of equilibrium conditions which maximize utility within given budget constraints. For each library, it is necessary to have statements prepared by the librarian and/or the next higher echelon which define for the library:

(1) the library mission;
(2) the library goals and objectives supporting the mission;
(3) the particular services and products of the library which implement the goals and objectives.

It is the intention to make a number of determinations. These are:

(1) Determination of the inputs and outputs of each service and the relationships between inputs and outputs.
(2) Determination of the factors to be maximized for each service relative to the purpose of the library. For example, most private industries have a central purpose of maximizing profits. A library may also have a central purpose which may be to maximize the percentage of within-mission needs met or to maximize the value of library services and products in supporting research and development activities of the users.
(3) Determination of a means of measuring the utility of the factors to be maximized.
(4) Determination of the operations to be performed in the effort to maximize utility of each service or product.
(5) Determination of standard output units per man-hour for each operation.
(6) Determination of the change in utility (ΔUi) of each service i with respect to the change in each operational output unit (ΔOj), where $\frac{\Delta Ui}{\Delta Oj}$ = marginal utility of service (i) with respect to operation (j).

For example, to determine the marginal utility of a given operational output, it is necessary to describe a utility curve such as shown in Figure 10. This curve is described by plotting points on utility-output co-ordinates. Various operational output quantities are plotted against their utility. The output quantities can be arbitrarily chosen to deviate from existing outputs. In Table 1 the existing output is eighty standard man-hours of work. The deviations are in ten man-hour increments above and below the existing output. Judgments are then made of the utility of each service derived from the various outputs. The marginal utility of the existing output can be represented by the average slope of the utility curve between points 3 and 4 (P_3 & P_4) or $\Delta Ui_3/\Delta Oj_3 = 3.0$ (or ideally at P_3).

(7) Determination of the total change of utility ΔTUj of operation (i) with respect to the change in operational output ΔOj where $\Delta TUj/\Delta Oj = MUj$ = marginal utility of respective operations outputs.
(8) Determination of the cost per man-hour at 100 per cent utilization for each operation.

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* The term 'output' can denote different meanings depending upon which part of the system it refers to. In this section, unless otherwise stated, the term is meant to be a measure of operational actions, not a measure of number or quality of services or products. In this sense operational outputs are inputs toward producing services or products.

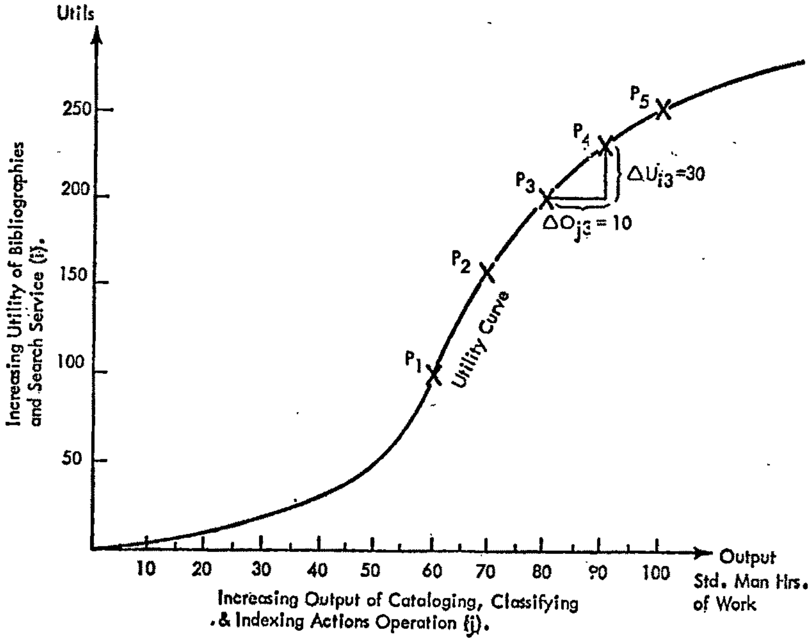

FIG. 10.

Point	Operational Output	Utility of Service Derived From Operation	Marginal Utility $\Delta U_i/\Delta O_j$
1	60 man hrs.	100 Utils	$\frac{160-100}{70-60}=\frac{60}{10}=6.0$
2	70 man hrs.	160 Utils	$\frac{200-160}{80-70}=\frac{40}{10}=4.0$
3	80 man hrs.	200 Utils	$\frac{230-200}{90-80}=\frac{30}{10}=3.0$
4	90 man hrs.	230 Utils	
5	100 man hrs.	250 Utils	$\frac{250-230}{100-90}=\frac{20}{10}=2.0$

TABLE I.

If these determinations can be made, it will be possible to establish criteria for allocation of man-hours in such a way that overall utility of operations and services may be maximized. The equilibrium condition for maximum utility exists when total budget for operations (*I*), amount of each operational output (*A*, *B*, *C*, . . . *N*), price of each operational unit (*Pa*, *Pb*, *Pc*, . . . *Pn*), and marginal utility of each operational unit *Mu*, *Mb*, *Muc*, . . . *Mun* satisfy the following:

(1) $I = APa + BPb + CPc + \ldots + NPn$

(2) $\frac{MUa}{Pa} = \frac{MUb}{Pb} = \frac{MUc}{Pc} = \ldots = \frac{MUn}{Pn}$

If these equations cannot be satisfied, it may be possible to optimize man-power allocation to approach utility maximization. If there are constraints other than budget constraints, such as man-power constraints, it may not be possible to maximize utility. Regardless of constraints and barriers to utility maximization at the point of equilibrium, criteria may be developed to indicate the optimum balance between budget allocation and utility.

The following example will serve to demonstrate the utility analysis approach.

Example:

Figure 11 is a total and marginal utility schedule for estimates of long run utility of operations and services. For this example, only eight services and eleven operations are considered as the significant operations and services at a hypothetical library. The value to be maximized is, in this case, the utility of the services in meeting the within-mission needs of the users. The output units being measured, which contribute to utility, are standard work units expressed in terms of standard man-hours of work (third column from right).

The numbers underlined in the schedule are existing output (standard man-hours of work) and utility (utils*) measures for each operation. The standard man-hours of work produced (in the output column) is the same number as the man-hours worked (in the operation input column) when the operator is working at 100 per cent utilization. For the purposes of this example we will assume all operators are working at 100 per cent utilization. The other numbers in the schedule represent utility and marginal utility changes at various output changes.

If the library is operating at a point of maximum utility within budget constraints, the following conditions must be satisfied.

(1) $I = APa + BPb + CPc + DPd + EPe + FPf + GPg + HPh + IPi + JPj + KPk$

say: $Pa = \$3.00$, $PB = \$5.00$, $Pc = \$4.00$, $Pd = \$3.00$,
$Pe = \$3.00$, $Pf = \$2.00$, $Pg = \$5.00$, $Ph = \$4.00$,
$Pi = \$4.00$, $Pj = \$2.50$, $Pk = \$6.00$

(2) $\frac{MUa}{Pa} = \frac{MUb}{Pb} = \frac{MUc}{Pc} = \frac{MUd}{Pd} = \frac{MUe}{Pe} = \frac{MUf}{Pf} = \frac{MUg}{Pg} = \frac{MUh}{Ph} = \frac{MUi}{Pi} = \frac{MUj}{Pj} = \frac{MUk}{Pk}$

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* Utils—an arbitrary unit which represents amount of utility or value.

Estimates of Long Run Utility

SERVICE OR PRODUCT			S.D.I.	TRANSLATIONS	BIBLIOGRAPHIES & REFERENCE SEARCH	CIRCULATION UPON REQUEST	CIRCULATION PREDETERMINED	ABSTRACTS	REPRODUCTIONS	USERS SEARCH	Total & Marginal Utility of Operations		
Existing Utility of Each Service or Product in Meeting within-Mission Needs of the Users.			100	50	500	500	50	50	50	1000			
Operation Output Symbol	Operation	Operation Input–Man Hrs.	Utility	Utility	Utility	Utility	Utility	Utility	Utility	Utility	Output–Std. Man Hrs. of Work.	Total Utility	Marginal Utility.
A	Cataloging Classifying & Indexing Actions	60 70 80 90 100	65 80 90 93 95		100 160 200 230 250					100 225 300 350 375	60 70 80 90 100	265 465 590 (673) 720	20.0 12.5 8.3 4.7
B	Performance of Searches	20 30 40 50 60			20 40 50 60 70						20 30 40 50 60	20 40 (50) 60 70	2.0 1.0 1.0 1.0
C	Bibliographic Listing Actions	10 20 30 40 50			10 20 25 30 30						10 20 30 40 50	10 20 (25) 30 30	1.0 .5 .5 .0
D	Circulation Upon Request Actions	50 75 100 125 150				50 85 100 110 115					50 75 100 125 150	50 85 (100) 110 115	1.4 .6 .4 .2
E	Circulation by Predetermined Listings Actions	5 10 20 30 40					13 20 25 28 30				5 10 20 30 40	13 (20) 25 28 30	.6 .5 .3 .2
F	Preparation & Maintenance of Collection	5 10 20 30 40	3 5 10 12 13		3 5 10 12 13	24 40 80 96 100				35 50 75 100 115	5 10 20 30 40	65 100 (175) 220 241	4.2 3.0 2.0 .6
G	Translating Actions	10 15 20 25 30		25 40 50 56 60							10 15 20 25 30	25 40 (50) 56 60	3.0 2.0 1.2 .8
H	Users' Education Actions	5 10 20 30 40			11 12 15 20 30	11 12 15 20 30				130 150 200 260 310	5 10 20 30 40	152 174 (230) 300 370	4.4 5.6 7.0 9.0
I	Abstracting Actions	10 20 30 40 50						15 20 25 30 35		10 15 25 35 50	10 20 30 40 50	25 35 (50) 65 85	1.0 1.5 1.5 2.0
J	Reproduction Actions	10 20 30 40 50				1 3 5 6 7			30 40 50 60 70		10 20 30 40 50	31 43 (55) 66 77	1.2 1.2 1.1 1.1
K	Acquisitions Actions	50 75 100 125 150			100 150 200 250 300	75 200 300 375 400	10 15 25 32 35	20 23 25 26 27		200 300 400 500 600	50 75 100 125 150	405 688 (950) 1183 1362	11.3 10.5 9.3 7.2
L	Staff Training Actions												
M	Inter Library Loan												

FIG. 11. *Total and marginal utility schedule.*

Utilizing the output data in the third column from the right, when the total budget for operations is \$2200/week, condition (1) requires that:

$$\begin{aligned}\$2200.00 = {} & (80)(\$3.00) + (40)(\$5.00) + (30)(\$4.00) + \\ & (100)(\$3.00) + (100)(\$3.00) + (20)(\$2.00) + \\ & (20)(\$5.00) + (20)(\$4.00) + (30)(\$4.00) + \\ & (30)(\$2.50) + (100)(\$6.00).\end{aligned}$$

This reduces to:

$$\$2200.00 = \$2175.00.$$

It can be seen that the library does closely approximate the first condition.

Utilizing the marginal utility data in the first column from the right, and the prices of respective output units condition (2) requires that:

$$\frac{8.3}{3.00} = \frac{1.0}{5.00} = \frac{0.5}{4.00} = \frac{0.4}{3.00} = \frac{0.3}{3.00} = \frac{2.0}{2.00}$$

$$\frac{1.2}{5.00} = \frac{7.0}{4.00} = \frac{1.5}{4.00} = \frac{1.1}{2.50} = \frac{9.3}{6.00}.$$

This reduces to:

$$\begin{aligned}& 2.80 = 0.20 = 0.13 = 0.13 = 0.10 = 1.00 = 0.24 = 1.75 = \\ & 0.38 = 0.44 = 1.55\end{aligned}$$

It can be seen that the library does not closely approximate the second condition. Therefore, in order to maximize utility it will be necessary to add output to operations where $\frac{MUj}{Pj}$ = the largest number. Since $\frac{MUa}{Pa} = 2.80$ and 2.80 is the largest $\frac{MUj}{Pj}$, then we should add output (A) to cataloguing, classifying and indexing and reduce output from operations where $\frac{MUj}{Pj}$ = the smallest number. Since $\frac{MUe}{Pe}$ = the smallest number = 0.10, we shall remove 10 units of E (ten man-hours) and allocate the cost of ten man-hours of E (10 + \$3.00 = \$30.00) to A. If we add \$30.00 to A, we will add ten man-hours to A since the Pa = \$3.00/man-hours.

The change in allocation of funds causes a change in total utility. The numbers in the total utility column which are underlined represent the total utility of operations before the change. The numbers in the total utility column which are in parentheses represent the total utility after the change. Because of the reallocation of funds the utility of E drops 5 utils, and the utility of A increases by 83 utils. Therefore, a net long run gain of 78 utils is predicted by spending \$30.00 less on predetermined circulation and \$30.00 more on cataloguing, classifying and indexing.

At this point, before the change is made, the purpose for the change and the effect of the change must be reviewed. The purpose is to maximize utility of total operations in meeting the within-mission needs of users.

The effect would be decreased predetermined circulation and increased cataloguing, classifying and indexing. If there are no obvious constraints upon reducing predetermined circulation or increasing cataloguing, classifying and indexing, the change should be recommended, reviewed by top management and implemented if approved. Disapproval would constitute a constraint and, therefore, may be a barrier to maximizing utility of the operations in meeting the within-mission needs of the users. However, if there are barriers such as (1) no additional qualified cataloguers are available or (2) top executives insist that predetermined circulation should not be reduced, it will be necessary to optimize services utility by seeking other changes which will resolve greater total utility. Perhaps adding man-hours to H and reducing man-hours of C or D may be accomplished.

Operation D is circulation actions. Assuming that the personnel performing circulation actions are fully utilized in serving clients, the man-hours reduced should be accomplished by increasing efficiency of circulation operations; otherwise reduction in man-hours could cause a bottleneck which reduces user satisfaction.

The utility approach, therefore, is useful in pointing out the operations which should be concentrated upon first to improve methods and efficiency in order to free labour for more effective and utility-maximizing operations.

In the case of increased total manpower for operations the additional man-hours should be added where $\frac{MUj}{Pj}$ is largest. In the case of staff cuts the man-hours should be reduced where $\frac{MUj}{Pj}$ is smallest.

Conclusions

We are grateful for having had the opportunity to present the foregoing thoughts on criteria for evaluating the effectiveness of technical libraries Several of the concepts discussed in this work toward the origination of criteria are as yet largely in the development stage. Our own Phase III study should provide validation of some of the concepts and, hopefully, the basis on which certain standards might be founded. It is anticipated that additional experimentation and data gathering will be necessary before some of the criteria and methods will be accepted. Some of the concepts are not simple and require study and familiarization before their value can be realized. It is hoped and recommended, therefore, that such studies will be made and, if possible, instruction courses instituted to familiarize librarians with the features offered.

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DISCUSSION

Dr W.E. Batten (ICI) said that many steps in the total system were part of several subsystems. How could costs and measures of effectiveness be allotted in order to get a true picture?

Dr Wessel agreed that this was a problem and said that considerable refinement of the use of the technique of Utility Analysis was desirable.

Mr Groeger (John Laing R & D) said he was particularly impressed by the Utility Analysis approach. They were using this approach at his library where they called it 'management by objectives'. He thought that if the impetus was not forthcoming from management, it had to come from the information scientist or the librarian. Objectives, measures and targets should be defined and this should be followed by pay rewards. It was not so difficult as it sounded; they had made an hour-by-hour analysis in order to achieve a standard of efficiency.

Dr Wessel said he was delighted to hear that others were working in the same area. He thought that many were, if only unconsciously.

THE DEVELOPMENT OF SDI SERVICES

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TEN years have elapsed since the publication of Luhn's conceptual paper 'A business intelligence system'[1] in which he visualized the employment of e.d.p. equipment for a 'service within an organization which concerns itself with channelling new items of information, from whatever source, to those points within an organization where the probability of usefulness in connection with current work or interests is high'. In a later paper,[2] Luhn elaborated on the selective dissemination function. From this seminal paper, the development of SDI systems, first by IBM and then others, can be traced.

The literature on this topic is now large and includes a number of state-of-the-art surveys.[3, 4, 5] Particularly worthy of mention is the review recently (1967) published by Judith Holt Connor[3] in the *Library Quarterly*, in which the author relates the history of SDI developments, discusses evaluation techniques and reviews operational SDI systems, particularly those functioning in the United States, where the activity in this area is most concentrated. In this paper I shall attempt to identify discernible trends in design, and to relate recently developed systems in the UK to these trends.

There has not been, by any stretch of the imagination, a wholesale rush towards the development of mechanized SDI systems in the UK. In part, this may be related to the scarcity of computerized information systems of any sort. Connor suggests that the increase in the number of SDI systems in the United States can, to some extent, be attributed to the relative ease of modifying existing mechanized information retrieval systems to perform an SDI function. But in the UK few, if any, of the existing SDI systems have developed directly from such origins. There are a number of factors which may have had an influence. First, and important, is the relatively high ratio of the cost of mechanized to manual operations in the UK compared with that in the USA. In other words, the relative cheapness (and availability) of human effort in this country has not created great incentives to mechanization. The picture, however, is changing and will continue to do so. Also there are relatively fewer large and complex industrial and institutional organizations in this country. Furthermore, in many industrial situations there are well-developed 'conventional' information services which have provided current awareness services, without the benefits of mechanization, for some time.

There are probably not more than ten mechanized SDI systems in the UK, of which seven will be mentioned in this paper, and five, which have been reported in the literature, will be examined in some detail. These systems could be variously described as in developmental, experimental or operational stages. It is perhaps indicative of local attitudes that four of the five systems described here include some kind of 'evaluation' in their programmes, and the fifth—a commercial enterprise—will at the least have the judgment of the market place to consider.

SDI Systems in the United Kingdom

The Chemical Society Research Unit[6] (University of Nottingham)

This unit is experimenting with a number of services: here attention is restricted to those using input supplied from the Chemical Abstracts Service in the form of magnetic tapes containing information from the publications *Chemical Titles* (CT) and *Chemical and Biological Activities* (CBAC). The tapes are received fortnightly and run against the profiles of scientists working in university and industrial environments. The unit has developed its own suite of programs for use on a KDF 9 computer. There are about 192 users of the CT service and 131 of the CBAC service. Each fortnightly run of the CT tapes handles approximately 4,700 titles of journal articles; about 630 'digests' per fortnightly issue are examined in the CBAC tapes. The unit, which offered its services free (it receives support from the Chemical Society and OSTI) during the experimental period is now recovering the cost of the services by charging a basic fee of £35 per annum per profile of ten terms yielding not more than fifty output notifications per fortnightly run. Larger profiles and more voluminous output require an increased subscription.

UKAEA Culham Laboratory[7]

The SDI service at Culham came into operation in 1966 and was originally aimed to serve the current awareness needs of users in the laboratory. The scope has recently extended, and notifications are now provided to users outside the laboratory, both in this country and abroad. The material handled deals with plasma physics and related subjects. An existing service, which provides an information bulletin has been mechanized so that material of potential interest to individuals can be selected by the matching of document and user profiles with the aid of a KDF 9 computer. The programs were written locally. Input consists of titles, authors and references from journal articles and reports (additional terms are frequently added to the latter). The average weekly input to the system is seventy-five journal articles and thirty-five reports. About one hundred profiles representing the interests of users at Culham are in the system. Recipients of notifications at Culham have rapid access to original documents through the library service.

INDATA Ltd[8]

The INDATA service is a commercial undertaking which went into operation in mid-1967. It provides engineering specifications of equipment and components in the electronics and automation field. A series of market studies preceded the system development which included sixteen man-months of programming. Information from manufacturers is examined by engineers who produce a detailed engineering specification and a text description of each product. Products are classified according to a list of 309 basic categories. The user can receive a variety of outputs from the system. By subscribing to an individual profile list (annual charge £15 per fifty categories), the user can obtain weekly listings of new products matching his profile, containing product titles, the manufacturer's name and an accession number. The accession number refers to a product card file (printed by off-set, on eighty-column cards) on which is printed the detailed information described above. The total file of all categories of product cards, plus a master accession list, and inclusive of maintenance of cards in a modular binder system by service girls, requires a subscription of £375 per annum. Feed-back from the user wanting further information is provided by prepunched reply stubs on the product cards, which can be marked and returned to the centre, where requests are forwarded to the manufacturer. The system employs an IBM 360–40 system, the files being maintained on disks.

Standard Telecommunication Laboratories Ltd[9]

An experimental system dealing with SDI of electronics information has been developed and tested at STL. Three hundred and thirty-six engineers were involved in the experiment. A thesaurus of approximately six thousand terms was constructed, and this was used in the construction of user's profiles. The input to the system consisted of approximately ten thousand abstracts from *Science Abstracts, Section B,* plus a small number of research and development reports, and patent abridgements. Indexing was performed on an experimental basis by three groups: engineers specialising in the subject being indexed, engineers not specialising in the subject, and professional indexers. Natural language descriptors entering the system were converted, by program look-up, to a concept number. Words with identical stems were reduced to the same concept number, as were certain synonyms. The computer used for this experiment was an ITT ADX 7300.

The Institution of Electrical Engineers

The SDI investigation of the I.E.E. is based on the National Electronics Research Council's SDI Project,[10] the responsibility for which has been transferred to the Institution. It is designed to assess the value, economics, efficiency and acceptability to users of a system that is being established to serve about six hundred electronics research workers in universities and industrial and government research establishments. The system takes material in the form of English-language periodical articles dealing with electronics research (expected receipts: 250 items per week). The indexing language being used is based on a thesaurus developed for *Electrical and Electronics Engineering*

Abstracts. Term relationships in the user profiles are being expressed in terms of Boolean logic. The computer programs for the system were developed by English Electric Computers Ltd. for use on a KDF 9 machine. The computer service for the investigation is being provided by the Documentation Processing Centre of OSTI. The service is being run free of charge for an experimental period of two years, during which time it is proposed to conduct the following tests and assessments: (*a*) the performance of the system (in terms of recall and precision), (*b*) the rate of change of profiles, (*c*) a comparison of the value of titles only, titles with lists of descriptors, and titles with abstracts, for assessing relevance, (*d*) the value, usefulness and acceptability of the service, (*e*) the acceptability of different kinds of notification, (*f*) the effect of the SDI service on the users' information gathering habits.

Other SDI Operations

At least two other organizations: Shell at Sittingbourne and AERE at Aldermaston[11] are using magnetic tapes for SDI purposes, supplied by the Chemical Abstracts Service, similar to those employed at Nottingham. An unknown number of users in the UK is also subscribing to I.S.I.'s ASCA service, and a comparison of the ASCA and the Nottingham services has been discussed by Abbot and others.[12] British-based employees of IBM have been in receipt of SDI services, generated from outside the United Kingdom, for a number of years.

A Comparative Review of SDI Systems

In this section I am drawing heavily on an excellent review by Bivona and Goldblum,[4] who analysed seventeen systems operational in the United States. The general form in their review is being followed, supplemented by local information and discussion.

A. Data Input

There are three types of input to an SDI system: information sources, user profiles with addresses, and user responses. The information sources consist of reports, journal articles, books, patents, etc., in hard copy or surrogates thereof in machine readable form.

I. Information Sources

(*a*) *Machine readable data.* A number of agencies are now providing machine readable records derived from documents. These include DDC, NASA, NLM, CAS and ISI, and we can expect an increase in this type of material. As mentioned earlier, a few systems in the UK are processing CAS material in the form of magnetic tapes containing information from the *Chemical Titles* and *Chemical and Biological Activities* publications. The obvious advantages of using this type of material are the breadth of coverage and the timeliness of announcement. Also important is the relative cheapness of buying ready made tapes as compared with the cost of locally rendering the material into a machine-readable form. Against this is the disadvantage (as in the case of CAS tapes) of the lack of vocabulary control, which complicates the construction of user profiles. The advent of 'Chemical Condensates' tapes in the near future, in which there will be a more rigidly controlled vocabulary, is thought by many to offer a more satisfactory input material to SDI systems serving chemists.

Magnetic tapes from DDC and NASA contain all the information that is printed in the TAB and STAR announcement journals, respectively, and are being used in the US in some SDI systems. The US Army Biological Laboratory at Fort Detrick is using MEDLARS (subject heading) tapes as a data base for SDI. The Institute for Atomic Research (Iowa State University)[13] uses two machine readable sources: the ISI *Science Citation Index* and *Nuclear Science Abstracts*, and is designed to accept others.

(*b*) *Non-machine readable input.* For systems which do not accept externally generated magnetic tape as input, it is prepared usually in the form of punched cards or punched paper tape. In the Culham system, records for the SDI service, which include items which are to be presented in an information bulletin, are prepared on a tape typewriter. The paper tapes perforated by this process are read into the computer which then produces SDI notices printed on the line printer and, once a week, a punched paper tape containing sorted bulletin entries. The latter tape is fed into the tape typewriter to produce an off-set master of the bulletin. The Culham system, like those which employ *Chemical Titles* tapes, performs an 'auto-indexing' routine on titles in order to derive terms to match against user profiles. The IBM system extracts terms from full abstracts. All the other systems reported have a manual indexing stage: the INDATA material, for example, is classified by reference to a list of 309 basic categories, with the aid of a 'lead-in' thesaurus of 850 terms. In some systems weights, links and roles are also assigned to indexing terms. Bivona and Goldblum report that the use of links in the Douglas system was discontinued because 'the time spent in accurately linking descriptors was a more significant problem than the false drops occurring during several years of program operation'.

II. User Profiles

There are wide variations in the techniques applied for constructing user profiles. In the simpler type of system, e.g. INDATA, there is little difficulty the user choosing one-term profile words from a proferred list. More usually profiles are prepared by collaboration between the user and a system operator, and as a user gains experience of the system, he becomes more effective in selecting his own terms. The Nottingham unit provides a user's manual and staff have lectured on profiling techniques. The unit has, however, throughout its experimental period, encouraged users to construct their own profiles. Because term truncation is an important feature of the Nottingham system, a computer-produced index of term fragments (KLIC—key letter in context) has been made by the unit to aid in terms selection. In the IEE system, potential users are asked to supply an account of their information requirements in narrative form, together with citations of articles which the user considers to meet some of the subject requirements specified. Profiles are then constructed on the basis of this information by the information staff, and users are not trained in the logic used in their profiles, nor are they provided with copies of the thesaurus, from which profile terms are selected.

III. User Response

Most SDI systems provide some means of response by the user, usually as a preprinted form. Statements of the relevance of the material supplied to him, the timeliness of the information (has he already received it through channels other than the SDI system?), and requests for abstracts or hard copy of original documents can be fed back by the user to the system. Often the response medium is in the form of a mark sensing or a port-a-punch card, which is machine readable. In one case[13] the feedback is used to automatically adjust the user's profile.

B. *Strategies of Profile Matching*

A careful study of selection logics has been reported by Sprague,[14] based on research done at the Aerospace Research Applications Centre. Sprague compared four methods of document selection in an SDI service which uses tape input from the NASA system. The indexing and document input were constants for the four systems, the variables being the selection criteria—Boolean logic, number of terms matching, percentage of terms matching, or sum of weighted terms. These criteria were compared for their effect of minimizing two types of error, 'Miss' (relevant documents not selected) and 'Trash' (irrelevant documents selected). The cost of Miss and Trash for various values of K were calculated using the expression:

$$C = KM + T$$

where C is the cost or detriment to the user (in terms of the cost of sending and receiving trash items), M is the number of missed documents and T is the number of trash items. K is a constant which reflects the user's opinion on the relative cost of Miss or Trash. (A user wanting high precision will choose low values of K; one wanting high recall will choose high values of K.) For a given value of K, the system which had the lowest cost was said to be best. The results of the study showed that the weighted term logic performed best for all cost functions, and that the relative performance level of the Boolean system decreased as the cost of missed documents increased. Bivona and Goldblum state that the most popular strategy is the weighted term approach—an approach used in the Nottingham Unit, at Culham, and at STL. They also believe that there is sufficient evidence to conclude that 'the MUST, NOT, MAY search strategy produces a system which is ultra-sensitive to the balance between relevancy and recall'. The weighted term approach has an additional advantage for systems which process a large number of documents per cycle—it is possible to limit the total number of selections by only printing out those with the highest scores.

The Institute for Atomic Research system[13] has significance values, originally assigned by the scientist, attached to each term of the user profile. The degree of similarity between a document and a user profile is determined by the sum of the significance values. If this sum is greater than, or equal to a threshold value (which can be varied according to the type of document input), the document is selected.

C. *Output*

The output of an SDI system consists of the notices sent to the user, original documents where these are requested and are available, and statistical reports.

I. User Notifications

All systems provide at least the title, author and reference of items retrieved. In the Culham system, for example, this is the total information recorded on the file. Frequently the profile terms by which the selection was brought about are also printed, many systems provide an abstract of the relevant documents. (Resnick's[15] study indicated that titles are as effective as abstracts as a basis for relevance judgments. Connor cites a study[16] in which, under some conditions, the contrary was suggested, and goes on to comment that 'at best any representation of the article is inadequate compared to a copy of the complete article'.) Notices are almost always printed by a computer line printer either on a paper form, or on (continuous) EAM cards, or 5 × 3 cards. Cards are more expensive to prepare but are possibly a more useful form for the recipient to handle.

It has been noticed in a number of SDI systems that profiles of users tend to 'cluster', and in some cases, it is possible to produce a group profile, covering the interests of a number of users. The Nottingham unit has experimented with a number of group profiles, and one output of the system is now 'Selective Current Awareness Notes: Radiation and Photochemistry'. The production of documents of this type, which can be reproduced cheaply, effects considerable savings of computer time both in selection and output.

II. Statistical Reporting

Most systems report statistical information of some kind: the number of notices sent, the number of documents selected, the number of relevance responses, etc. Some systems identify users who are getting low outputs, or terms in profiles which are not contributing to selection. Information of this type is used to evaluate the system and modify the profiles of individuals.

III. Supply of Original Documents

Some systems (e.g. the Nottingham unit) do not supply original documents in any form. Others supply tearsheets (ISI) or photocopies of originals. IBM puts all input documents on microfilm.

D. *Cost Analysis*

Bivona and Goldblum state that 'cost is not a trivial consideration in establishing an SDI system' and also 'a reflection on these high costs is evidenced, only by cryptic remarks in the literature'. Anthony and others[7] have estimated the manual vs computer costs of the Culham system, and shown that for that system they are roughly comparable.

A typical run on the *Chemical Titles* tapes at the Nottingham Unit of 336 profiles (eight thousand terms) against approximately 4,700 titles would consume six hours of KDF 9 time at the (university) rate of £60 per hour. (The Unit's scale of charges is given earlier in this paper.) Sage[13] reports an input of 6,500–7,500 entries per week is running for approximately three and a half hours per week on an IBM 7074/1401 computer (eighty-three profiles).

If 'tailor made' input on magnetic tape is not used, the cost of input preparation will very probably equal or exceed computer processing costs.

Development costs are usually totally ignored in any general costing. Figures of up to twelve man-months of programming effort have been quoted, much depending on the system and the programmer. The Indata suite (which consists of twenty-nine programs) required sixteen man-months of programming.

Evaluation of SDI Systems Efficiency

A number of measures have been proposed and are being used in an attempt to determine the efficiency of particular systems.

Relevance (precision) and recall ratios are probably the most frequently used, particularly the former. Comparatively few systems report figures for recall, presumably because of the effort involved in determining the total number of relevant documents available in any one run. These measures also vary from profile to profile, and 'average' relevance figures for a system may not be very meaningful. Judgments of relevance will clearly vary from user to user, and may be influenced by a number of factors, for example, the volume of notifications received by the user. It would be extremely misleading to compare relevance/recall figures from one system to those from another, unless close comparability existed.

Another measure is the ratio of the average number of documents sent to the total number of documents scanned—the 'dissemination ratio'.

Yet another measure is the 'selection–participation ratio'; which is the measure of the number of descriptors in the profile that participate in the selection of documents. A high ratio here indicates a good match between the subject content of the profile and the data base.

In a recent paper, Savage[17] has critically examined the interpretation of data available from SDI systems. He first points out that the basic universe of discourse pertinent to SDI systems is UD, where U and D are users and documents respectively, and that the selectivity of the system is indicated by the percentage of UD that results in notices to users. (This is a variant of the 'dissemination ratio', mentioned above.) Defining his terms by the 2 × 2 matrix given below, Savage makes the following points:

	Accepted by user	*Not accepted by user*
System selected	Hits	Trash
System not selected	Miss	Pass

1. A comparative measure of systems is to compute $\frac{1}{\text{Miss} + \text{Trash}}$, this gives high scores for systems with less error and vice versa.

2. Hit ratios alone are a deceptive measure of performance (e.g. high Hit ratios can be obtained by increasing the specificity of the profiles, but this tends to increase the chance of Miss).

3. Without an estimate of Miss we have no method of determining the *a priori* match between user and document populations.

4. 'For simple economic reasons high selective reaction and high *a priori* match are to be preferred. The first of these is a systems processing problem, the second is an acquisitions problem. Without knowing Miss, we do not know which'.

5. Data on Miss forces on the systems operators the necessity for accounting for systems error.

6. Estimates of Miss + Trash give the data for actual comparisons among alternative systems.

General discussion

There is little doubt that we shall see a continuing growth in the number, size and scope of SDI services. To some extent this will be necessary to meet the psychological need that many scientists, technologists and others feel when faced with increasing volumes of literature. SDI has an element of user participation in it which is perhaps more acceptable to some users than the passive receipt of information from more traditional services. Succeeding generations of computers are increasing the feasibility and decreasing the cost of handling large files of information. Moreover, many abstracting and indexing services have computers for production purposes, and are able to release machine readable records which may be used for SDI purposes (even if they were not specifically designed for this). Centralized production of data bases is cheaper local *laissez-faire* activities.

Centralized manipulation of tapes for SDI purposes also has economic advantages, but is only likely to be acceptable where there is ready interaction between the centre and the individual or group. Many user groups would almost certainly need to have access to a number of SDI services, particularly if the trend towards discipline-oriented services continues. For some groups, particularly the larger industrial ones, centralized services may well have the function of 'coarse screens'; refining and supplementation at a local level will be necessary.

Selective dissemination is only a part of a larger problem. SDI systems function on the assumption that a significant proportion of the notifications sent will arrive at or very close to the time when the information selected closely matches the needs of the user (whether he is conscious of them or not) at that moment. Clearly, what is relevant to a user is a function of the time of its availability, and information already in the archives may be much more important than that with which he is being supplied currently.

Little has been written on the evaluation of SDI systems, and clearly much more can be done in this area. Judging a service on its ability to attract cash customers may ultimately be the only practical approach, but we need much more information on which to make our value judgment. And although there is a small but growing knowledge of how users react to SDI systems, very little indeed is known about the effect of the systems on the information-gathering habits of individuals or groups. Again, this is part of a larger and more general problem—the benefits of information services to users. This sociological problem is far more complex, baffling, and important than the technological aspects on which this paper has concentrated.

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EXPERIENCES AND PROBLEMS OF ELECTRONIC DATA PROCESSING ENCOUNTERED BY THE UNIVERSITY OF BOCHUM LIBRARY

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Paper presented at the 42nd Aslib Annual Conference, Canterbury, 22nd–25th September 1968

AFTER five years' experience with electronic data processing at the University of Bochum Library it is now possible to derive some conclusions as to its practicability. The automation stage reached so far includes automation facilities with regard to circulation and alphabetic cataloguing operations, whereas other processes such as binding control, union catalogue of serials, acquisition, and classified cataloguing are only partially automated. As soon as the university library began its work in 1963 plans concerning the eventual automation of all operations were at once submitted, with the result that two departments never existed in traditional form, i.e. the cataloguing and circulation departments. The planners of the electronic data processing system in Bochum pursue the aim of building up an integrated system which includes all departments of the library. At the outset it was hoped to reach this end within a period of five to six years. But five years of practical programming have shown that it is impossible to develop an integrated system in such a short time. The automation of a department is effected in several steps. After finishing the basic plans the programming of a department takes from twelve to eighteen months. On this basis it was expected to complete a fully integrated system in five or six years' time. But in the course of operations it turned out that a lot of alterations and corrections are necessary, and this for two reasons:

1. Even the best programme elaborated with regard to operations as extensive as cataloguing and circulation can impossibly cover all potentials of these departments. Some cases and possibilities which appear in extreme situations only require corrections of the programme developed so far. But luckily these cases seldom occur.

2. There have been alterations as a result of modifications of the organization of a department which turned out to be necessary during the test period. It is, in fact, almost impossible to find the most effective system by theoretical means only.

Automation of a library does not simply mean the working processes by a computer. At the same time it is necessary to develop new organizational principles which ensure that the maximum benefit will be derived from the changes made. When this is done two difficulties are encountered:

1. On the one hand each plan is based on the traditional systems. Theory alone cannot always supply the most appropriate method. In many cases

conventional processes are taken over, although electronic data processing suggests changes to be applied to the course of operations.

2. On the other hand if one department after another is successively shifting over from the old to the new system it is necessary to maintain some of the traditional processes in order to avoid a breakdown of communications between automated and non-automated departments. This difficulty is always apparent where the introduction of electronic data processing requires changes in the organization of a department. The starting point will always be the traditional structure of the department, whereas the aim to be achieved in many cases implies a new departmental system. The desired result can therefore only be obtained by several steps. An integrated system is not equal to the sum of automation measures taken by the individual departments; apart from the automation of each department it requires the additional effort of co-ordinating the different automation activities.

The lesson to be drawn from these experiences is that the conversion of a library to electronic data processing usually requires a period lasting much longer than is expected by merely adding together the times spent on establishing the programs. I now think that a period of fifteen to twenty years will elapse before the University of Bochum Library will have developed a comparatively successful system. This period of time, of course, depends on the number of librarians available for work in the planning and programming teams. For the time being the Library has three programmers, one of whom is a qualified librarian. There is no special planning team. All the planning is done by the librarian, assistant librarian, and chief programmer. These three have, of course, numerous other tasks to carry out, which accounts for another obstacle in the way to progressive automation in Bochum.

The automation problems discussed so far occurred in a favourable context: the Library is newly founded. Even before the introduction of electronic data processing, neither the cataloguing nor the circulation departments had ever operated according to conventional methods at Bochum. This means that these areas could be automated from the beginning, thus avoiding the transition from conventional to modern working processes. In other departments of the University of Bochum Library, however, new problems arose as a result of the fact that departments already existing and working in the traditional way had to be changed. It was necessary to interfere with current processes, and this became all the more difficult the larger the department was and the less feasible it was to convert the department as a whole during one phase. In the binding department the first automation measures were still relatively easy to carry out, the only problem arising from the fact that serials records had not yet been automated. To change the course of operations of the ordering and acquisition departments, however, produced more problems. In this field the experience gained by the University of Bochum Library are the same as those of US libraries such as the University of Chicago Library and the University of Illinois Library, which are also changing the mode of working of their acquisition departments. The University of Bochum Library therefore tried to divide the work performed by the acquisition department into several groups of activities and to automate these groups separately. Conversion is easiest where no order is placed and no invoice is received—which is the case with books which come to the library as gifts. This operation has already been completely automated. The next process to be automated concerned books belonging to a collection which was bought as a whole; again there was also no need for individual orders and invoices. The University of Bochum Library, which is still being established, has purchased many private libraries of this kind. A few weeks ago, however, initial steps were taken to shift the work done by the acquisition department from conventional methods to electronic data processing, which for the time being still meets with numerous difficulties from the point of view of organization. I think that two years will be required to solve all the problems concerning this department.

After five years' experience with automation and after three years' experience with a computer of its own, the University of Bochum Library has begun to evaluate the efficiency of the new process. It turned out, however, that it is not easy to come to precise conclusions on this question. The following difficulties arise:

1. To compare the cost of a conventionally operated library with that of an automated one often means comparing two units which actually are incomparable. German university libraries usually do not allow the user to go to the stacks in order to get himself the books he wants. Instead the user fills in a call slip and as a rule he collects his book at the loan desk the following day. To order a book therefore requires twelve to fourteen hours on the average. The University of Bochum Library has dropped this procedure altogether. It offers free access to the stacks and charges the loans electronically at the exit. The greatly improved service to the user at Bochum is therefore not due to electronic processes, but to a new organizational pattern: i.e. free access to the stacks. To mention another example: the circulation departments of German university libraries are usually open twenty-nine hours a week, that is five hours a day. The users of the University of Bochum Library are able to borrow books seventy-two hours a week. Any comparison made with regard to the two systems is, therefore, bound also to include the opening hours. The question to be asked should run as follows: How much would a conventionally operated library cost if its circulation department were open seventy-two hours a week? On the other hand it must be taken into account that for the time being only six thousand students attend Bochum University, which for this reason is still among the smaller German universities. This situation will change in four to five years' time when eighteen thousand to twenty thousand students are expected to attend, and the university will emerge as one of the largest in the Federal Republic. This development accounts for the fact that during the last year the figure for loans by the University of Bochum Library amounted to approximately seventy thousand books only, while other university libraries such as Cologne or Frankfort produce figures of 300,000 to 400,000 books on loan. Prior to a comparison of the expenses incurred by the University of Bochum Library and those of conventionally operated libraries a calculation should first of all be carried out as to how much the new system would cost if the library had to handle 300,000 volumes on loan. The amount will certainly not be four times last year's cost.

There is another reason still why it is difficult to calculate the costs. In its enthusiasm for automated processes, the University of Bochum Library has developed some of the early machine program solely from the point of view of the technical potential offered by the computer, neglecting considerations of efficiency. Thus for instance a system for loans was developed in which prior to the expiration of the loan period students were informed by letter stating that the books had to be returned. The cost incurred by this does not relate to the computer alone. The letters have to be folded and put into envelopes and the mailing of each letter requires a DM 0.30 postal charge. In the case of 100,000 loans the sum required would be DM 30,000 for mailing expenses only. In view of this expenditure the University of Bochum Library is bound to check its computer programmes in the near future in order to find ways and means of simplifying them.

The third difficulty encountered in comparing expenses relates to the problem of how much computer time a library really needs. As the University of Bochum does not yet have a computing centre, the library was equipped with a computer of its own. It is true that the computer is also used for purposes of university administration and building services, but it is attached to the library. This means that the library has a good deal of computer time at its disposal which to a great extent is used for experiments. As soon as the library has completed the development of an integrated system the computer time required will certainly be considerably reduced. This shows that a comparison of costs should not merely be based on the computer cost incurred at the present time.

If a cost comparison is carried out with these reserves in mind it can be said that on account of the experiences gained so far by the University of Bochum Library the efficiency of the cataloguing department is such as to justify a computerized system. On the basis of the information on cataloguing performances of conventionally operated libraries as provided by the Deutsche Wissenschaftsrat (German Council for Scientific Research) in its second expert opinion the cataloguing of a book costs about DM 3,90 on the average. According to the calculations carried out by the University of Bochum Library the price is DM 3,15 per title. It must, however, be taken into consideration that this cost will annually rise due to the fact that the complete catalogue has to be reprinted every year. The increase in printing time involves a higher share of cost. But for the next ten years at least the expenses for cataloguing by means of electronic data processing will be lower than those stated in respect of conventional methods. Cost estimates as to books on loan are much more difficult. If the expenses incurred by each hour the library is opened are compared it results that the system developed by the University of Bochum Library only causes cost amounting to about one fourth of that mentioned for conventional systems. If, however, the cost for each individual loan process is compared the Bochum system turns out to be twice as expensive as the traditional one. In spite of this I think that with the increase of loan figures in Bochum in a few years' time the cost will be more or less the same as encountered by conventional methods even if the opening hours are longer.

For the reasons mentioned above a cost comparison will always be a matter of approximation only.

PROGRESS WITH DATA CENTRES

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Introduction

CRITICAL reference data may be defined as the critically evaluated measurements of basic properties of definable systems. Such data are selected after rejection of inaccurate or ill-defined measurements or measurements which do not relate to definable properties and materials. The earlier collection and compilation of reference data was confined to areas where there were groups of scientists willing to undertake the compilation and where there was a clear interest in their use. Following the recognition that the task of critical data compilation, long left to individuals or groups, needed proper examination, co-ordination and financing, some centres, a notable example being the National Bureau of Standards, United States, have undertaken a broad and systematic attack on the problem to identify and fill the gaps and to ensure a uniformly good quality of output. In June 1963 a National Standard Reference Data System was established within the administration of the National Bureau of Standards, the actual responsibility within the NBS being assigned to the Office of Standard Reference Data. The extent of the activities of the NSRDS at the present time is surveyed in NBS Technical Note 448 which lists in detail the data activities falling within the national data system.

In 1964 the Information Division of the former Department of Scientific and Industrial Research took steps to establish an equivalent British programme, though on a much more modest scale. This involved the identification of current British data activities, deciding which of them it was appropriate to stimulate as part of the British contribution and assisting the necessary expansion of effort with financial support wherever appropriate. In all this activity close contact was maintained with the National Bureau of Standards.

Shortly after the above decision the International Council of Scientific Unions (ICSU) drew attention to the need for organized international co-operation on data activities and set up a Working Party to examine the problem. The Committee on Data for Science and Technology (CODATA) was established in 1966 with the object of promoting and encouraging on a world-wide basis the production and distribution of compendia and other forms of collections of critically selected numerical and other quantitively expressed values of the properties of substances of importance and interest to science and technology. To do this CODATA has agreed to outline the importance of the problem, to encourage scientists to appreciate and participate in compilation work, to encourage experimental programmes, to extend and complete compilations in important areas, to increase contacts among workers in this area by arranging meetings and exchange visits and to consider problems of financing and subsidies from various sources. It is the intention that the international activities of CODATA shall be supported by national committees in the associated countries. In the United Kingdom a national committee has been set up by The Royal Society—the British National Committee on Data for Science and Technology—which has the task of identifying the potential British contribution to the international effort. After a preliminary survey of current British activities, it was initially recommended that four areas were suitable for development, these areas being Crystal Data, Interatomic Distances, Thermodynamic Properties of Gases and some types of Spectral Data.

The Office for Scientific and Technical Information (OSTI)

Following the reorganization of the functions of DSIR in March 1965, it was decided that OSTI, a branch of the Department of Education and Science, should take over the functions relating to the international data programme and should be responsible for stimulating and supporting a national programme in collaboration with the British National Committee. In the field of critical data OSTI's functions are:

(*a*) to act as a national focus and co-ordinating centre for some areas of data in fields centred more on pure science than technology;
(*b*) to encourage the formation of centres for data compilation and information;
(*c*) to identify areas, and encourage development, where it can be shown that data compilation and data centres can usefully contribute to the national and international scientific effort.

The whole of data activities, even if restricted to numerical reference data, is an enormous and growing area beyond the ability of any single organization, and possibly of any country, to cover adequately and accurately. OSTI has taken the view, therefore, and in this we have the agreement of the British National Committee, that support should be restricted to a limited number of projects so that the centres selected could become national centres designed eventually to make a British contribution to the wider international scheme of collaboration. In deciding which projects to support, the following criteria are considered:

(*a*) The usefulness, cost and economic viability of the projected data centres as judged by independent assessors from universities and industry.
(*b*) The expertise of the staff available to run the centre, including their knowledge in the area of data compilation proposed for support: their experience in the handling of data on a large scale: and where appropriate, their access to suitable mechanized facilities, e.g. computers and peripheral equipment.

There appear advantages in associating a data centre with an experimental or measuring centre. Possibly at a later stage they might be associated with a specialized information centre, or information analysis centre, so that eventually the best form of centre may prove to be a combined data/information centre working in association with the experimental compilation of data and acting as an information centre on, e.g. advanced techniques, interpretation of results and correlations of results.

To assist policy-making in the field of data OSTI has produced a British list of critical data activities, the first edition appearing at the beginning of 1966 and a second edition appearing in 1967 under the heading *Critical data in Britain.* Some thirty-eight data activities were listed in the last edition though some refer to design data rather than critical evaluated numerical data. The revision of this list is now under consideration and when it is completed it will also serve as the United Kingdom national input into the initial CODATA survey of data activites. It is clear that any revision must include critical numerical data activities relating to the physical sciences and it is hoped to make this area as complete as possible. There are, however, other data activities of an uncritical or non-numerical nature that could be included, e.g. from environmental, geophysical and social science sources as well as from physical sciences. It would be a problem to define those data activities and they would also require a fairly substantial effort to compile.

CODATA Activities

The ICSU/Committee on Data for Science and Technology held its Third Annual General Meeting in Frankfurt in July 1968 followed by the First CODATA Conference. The purpose of the latter Conference was mainly exploratory and to allow scientists and technologists concerned with data activities to meet one another to consider problems of mutual interest. At the same time it was expected that a framework could be decided upon into which the future CODATA activities could be fitted. The members of CODATA consist of National (at present US, USSR, UK, France, Germany, Japan, Canada and Italy), Union (IUPAC, IUPAP, IUB, IAU, IUCr.) and Liaison (OECD, ICSU/AB, IAEA). The Secretariat and Offices, which were initially set up in Washington, have been transferred to Frankfurt as from 1st July 1968.

The initial tasks of CODATA will be to prepare an International Compendium of numerical data projects and this has already largely been completed while the CODATA Office was located at the Office of Critical Tables, Washington, U.S. It has been accepted by the Committee that the first edition shall be published quickly with a more careful revision for the second edition. The CODATA Office will also prepare a Newsletter, the first issue of which will be appearing later this year. In addition to the Compendium and Newsletter the Committee and Secretariat of CODATA will initiate studies of possible world centres and systems for numerical data and the part that CODATA can play.

Data Centres supported by OSTI

1. *X-Ray Crystallography*

Crystallography was one of the earlier disciplines to become aware of the data-handling problem and to take positive steps to identify and deal with it. The computer has made a significant contribution to the solution of the problem.

A strong experimental group at Cambridge has been receiving OSTI support for its data activities. These include:

(*a*) *Crystal Data.* Cambridge are preparing the next edition of this book in collaboration with the National Bureau of Standards in Washington (D.C.), using computer methods. Literature searches are carried out in Cambridge, where new material on crystals of carbon-containing compounds is abstracted and sent to Washington on standard coding sheets. The organic entries in the previous two editions are being edited and amalgamated with new entries when necessary.

(*b*) *Structural Library.* In the Spring of 1966 Cambridge began to build up a structural library on organic compounds to cover, in the first instance, all publications since 1960. The aim of the library is to have available structural data in a form suitable for computer processing. Critically edited data up to and including the atomic co-ordinated, standard deviations and isotropic thermal parameters, but excluding structure factors, will be stored on punched cards and eventually on magnetic tapes and discs.

The contents of the library were decided on in consultation with the Crystallography Group at Pittsburgh University, where a similar library on pyrimidines, purines and carbohydrates is being prepared and after discussions with an informal panel of crystallographers at the VIIth International Crystallographic Congress in Moscow in August 1966. The panel included representatives of most groups known to be interested in structural documentation work.

The first volume of this library has recently been completed. This is a bibliography of organic compounds covering the years 1960–6. Work is now in progress on the bibliography of 1967 literature.

(*c*) *Structure Reports.* For some years past the Cambridge group have provided the publication *Structure Reports* with periodic literature references. As a result of discussions with the Chairman of *Structure Reports* in Moscow the following arrangements were agreed, and the Cambridge group now provide *Structure Reports* with:

(i) Lists of authors and references of organic structural papers first for 1960–6, and then half-yearly.

(ii) Lists of calculated bond-lengths for medium size structures for the period 1960–6.

(iii) From 1967 onwards lists, in a form acceptable to printers, of the following data for reasonably sized organic structures: formula weight, crystal system, cell parameters and other measurements, space group, atomic co-ordinates, bond-lengths.

In return editors of the *Structure Reports* will provide Cambridge with brief abstracts of the type required for the structural library. The work on both projects would be greatly speeded up by further development of this type of collaboration and OSTI is concerned to see that such helpful international co-operation takes place.

2. *The Mass Spectrometry Data Centre*

The Mass Spectrometry Data Centre has been established with OSTI support, at the Atomic Energy Research Centre, Aldermaston, to handle the steadily increasing output of data in this field. The Centre acts as a depository for critically evaluated mass spectra and for data and information in closely allied subject fields.

It was accepted in the development of the Centre that computers were well suited to handling mass spectral data, and a number of computer-based services are already available. The Centre has produced since late 1966 the Mass Spectrometry Bulletin, which lists current references. This Bulletin has a world-wide circulation. Over 180 journals, which a survey showed to contain material of interest to the mass spectrometrist, are scanned and relevant titles transcribed, complete with reference, author and several key word index terms. These are then compiled on to magnetic tape, ordered by computer and printed out. Other programmes permit the production of indexes for the same input. The output is made up into sheets, photo reduced to quarto size and produced by offset lithography. The value of this system is its versatility, which not only eliminates manual indexing but provides magnetic tapes that are available for development of other services, and for sale or exchange.

The mass spectrum is most useful in analytical work, for comparison with the spectra unknown compounds, and the Centre has in its programme the problem of making available the large numbers of spectra already produced. Data in tabular form is compiled on to computer tape, and the print-out photo reduced and produced by offset lithography. This not only provides an easy-to-use data sheet but the tape provides a data base which may be used for matching mass spectra. Matching an unknown spectrum against one already on the tape poses new problems for the computer programmer, and the Centre is currently engaged on experimental work to solve these problems.

Many mass spectrometrists would prefer their data sheets in more convenient forms than hard copy, and the Centre is currently investigating the market for microfilm and magnetic tape versions.

It has always been OSTI policy to promote co-operation at an international as well as a national level, and in Berlin last September an International Advisory Committee on Mass Spectral Data was set up to deal with data problems. This Advisory Committee is attended by members of the United Kingdom Mass Spectral Data Advisory Committee and the Mass Spectrometry Data Centre.

3. *Thermodynamic Properties of Gases*

This Data Centre is international in character and is under the aegis of the International Union of Pure and Applied Chemistry. The Centre is situated at Imperial College and is served by working panels of experts from the USSR, USA, Belgium, Netherlands, France, Germany, Japan and the United Kingdom who provide critically evaluated data on industrially important gases such as carbon dioxide, oxygen, nitrogen, hydrogen, helium, halogens, fluorinated hydrocarbons and ammonia.

The Centre, under the directorship of Dr Angus, is financially guaranteed by OSTI, but also receives cash contributions from a number of other countries.

4. *High Temperature Reaction Rate Data*

In 1966 a special panel of our Science Research Council felt that the field of high temperature processes merited special stimulation and development and, consequently, the Council is now supporting a number of projects in this field.

Following this OSTI initiated two projects at the University of Leeds, one of them concerned with the establishment of an information centre on high temperature processes and the other with the compilation of critically evaluated kinetic data for reactions of interest in high temperature processes.

The first report of the former has now been completed, covering several reactions of carbon monoxide and carbon dioxide.

PROBLEMS OF REMOTE PROCESSING OF MAGNETIC TAPE INFORMATION FILES

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Paper presented at the 42nd Aslib Annual Conference, Canterbury, 22nd–25th September 1968

Introduction

THE effective use of machine-readable information files depends on many factors. Not the least of these is what, for want of a better term, might be described as the 'physical attributes' of the materials. Since January 1967 the Chemical Society Research Unit has been operating a current-awareness service based on magnetic tape versions of the Chemical Abstracts Service (CAS) publications *Chemical Titles* (CT), *Chemical-Biological Activities* (CBAC) and the 'Experiment in Selective Dissemination of Information' (SDI experiment). During this period we have been made acutely aware of the problems of processing magnetic tapes over whose quality we have no control and which originate at a considerable distance from the site where they are finally used. In the hope that an awareness of these problems may assist other potential users of similar materials in planning their activities I shall describe the Unit's experiences in some detail, and suggest some possible courses of action to alleviate some of the difficulties. Where appropriate I will relate the Unit's experiences to those which have been reported to me by three other groups of users of magnetic tape retrieval files:

(i) AWRE, Aldermaston (CT)
(ii) Woodstock Agricultural Research Centre (CT)
(iii) University of Newcastle Computing Laboratory (MEDLARS)

Shipment of Tapes

(*a*) *Timing*

Most operators of computer-based systems do not have unlimited access to a computer. At Nottingham the Unit is normally only able to use the machine on Saturdays; it is, therefore, important that tapes should arrive regularly and, ideally, on more or less the same day in the week so that the operators can take action to get computer schedules shifted if there are delays in shipment. Table 1 summarizes the pattern of arrival of tapes for CT and CBAC at the Unit during the period 1st January to 20th July 1968. For CT three out of fifteen tapes arrived too late to be run on the date set aside; the remaining twelve tapes arrived between four and eleven days prior to the run (mean 7.4 days). For a current-awareness service it is important to search new materials as soon as possible; advancing run dates by one week would have allowed us to search only eight of the fifteen tapes on time. Delaying the run date by a week would have allowed us to search all but one of the tapes on time but at the expense of an average delay between arrival of tape and run of 13.7 days. The particular run date chosen seems, in the circumstances, to have been close to the best that could be achieved. The position for CBAC is very similar. Eleven of fourteen tapes arrived in time for the scheduled run (from three to twelve days prior to the run—mean of nine days). Advancing the run date by a week would have resulted in ten of the tapes arriving in time; delaying it by a week would have allowed us to run all but one tape on time but at the expense of a mean delay of fourteen days.

Tapes for the Unit are airmailed from Columbus; Newcastle and Aldermaston use air freight. We have no direct evidence that the air-mail service introduces undue delays though it seems probable that the variation in day of arrival of tapes at the Unit is largely due to variations in timing of airmail deliveries. The MEDLARS group at Newcastle report that using air freight may result in delays in clearing customs unless special arrangements can be made.

The experiences of the groups at Aldermaston, Woodstock and Newcastle coincide, in general, with ours. Most tapes will arrive in time for a scheduled run provided that a realistic (seven days or so) interval is left between the date when the tape may hopefully arrive and the date when it must arrive.

Two conclusions may be drawn from these observations.

(i) it is unrealistic to expect the scatter of tape delivery dates to be less than one week even if everything goes smoothly

(ii) the providers of the tapes should give users a clear indication of the normal sequence of production and alert them immediately there is any deviation from this. CAS have very recently begun to do this and there is no doubt that it greatly eases the problem of rescheduling machine runs.

(*b*) *Cost*

Tape shipment is a fairly costly business. The average airmail costs to the Unit for tape shipment over the past nine months have averaged about $120 per quarter for CT and CBAC. Aldermaston report a cost of $70 per quarter for air freight on CT.

Contents of Tapes

Apart from delays in despatch or during shipping the other major cause of difficulties in processing tapes lies in errors of various sorts on the tapes themselves; these errors may, and often do, cause program failures or result in peculiar search outputs even if the program does not fail.

(*a*) *Parity*

Magnetic tape recording systems for digital computers incorporate procedures for verifying the data being written to the tape. At its simplest this takes the form of the recording of a parity bit associated with each discrete unit of information on the tape. On the IBM tape which the Unit receives from CAS each character is recorded as a magnetic pattern across the width of the tape. This pattern consists of six information 'bits', used to represent up to sixty-four possible characters in a binary notation (thus the binary number 001010 represents the numeral 0), together with a 7th parity bit. Depending on the system a convention of even or odd parity may be adopted; that is the hardware of the computer makes the number of non-zero bits in the character representation either even or odd by setting the parity bit appropriately to 1 or 0. In the case of the numeral 0 mentioned above, in an odd parity system the parity bit would be set to 1, so giving 3 non-zero bits in the final 7-bit pattern, and in an even parity system the parity bit would be set to 0. This parity bit gives some protection against accidental abuse of the information on the tape; there is a high probability that loss of one or more bits will result in a parity change from odd to even (or vice-versa) and this fact can be detected when reading the tape.

The presence of parity errors on a tape is normally regarded as an indication that there is a fault in the tape and the section of information contained in the area of the parity error will be ignored by the program. From December 1966 to the end of April 1968 the MEDLARS group calculate that 33 per cent of the tapes they received had one or more parity errors (up to twenty-three on one tape in one instance) which resulted in the loss of about two thousand citations. The Unit's programs are also adversely affected by parity errors and at one time a succession of tapes (about ten) received from CAS proved difficult or impossible to handle because of this. Recently, however, the situation has improved very markedly; during the past six months we have had no serious difficulty from this cause. This is almost certainly due not to an improvement in tape quality but to a phenomenon related to the recording and reading techniques used. If, as we suspect, the magnetic tape unit used to write the tapes is set up electro-mechanically in a slightly different way from the unit used to read the tapes, from time to time a parity error will result from the relative misalignment of the information written on the tape and the read heads of the tape unit reading it. Pressure on the engineers at the Nottingham installation finally improved the situation and we hope that it will not cause any serious problems in the future.

(*b*) *Tape Labels*

The CT and CBAC tapes used by the Unit should carry, as the first block of information, a header label which identifies the file. Of about ninety tapes received at the Unit, ten have had no header label. Initially our programs for transcribing the CAS tapes for use on our KDF9 computer expected to find a header label on the tape and failed to run if it was not present; at present, although the programs check the header label if they can, they will continue to run in the absence of a header label. Normally this procedure is perfectly safe since it is possible to identify the contents of the tape from the written label affixed to the tape reel at Columbus by their operating staff. On one occasion, however, the contents of a CBAC tape were not what was specified on the written label and it would have been quite possible to have completed a three-hour search before discovering that the wrong tape was being searched.

From the smaller number of tapes received by them, Aldermaston report one certain case of a missing header label, and two possible cases.

(*c*) *End-of-File Indications*

Just as a label at the start of a file is necessary to identify information on the file so an end-of-file (EOF) condition must be recorded to indicate to the programs using the tape that all useful information has been read. The Unit has a record of three tapes received from CAS which were not properly terminated and consequently unusable. At Woodstock 'several tapes with no EOF marker whilst one appeared to have the EOF marker two-thirds of the way along'. Aldermaston report 'mid-1967 we had a number of issues with no EOF's'. Unlike tapes with missing label blocks which can, with some risk, be accepted for processing, tapes with end-of-file indications missing cannot be used and a replacement tape must be sought.

(d) Tape Formats

The essentially moronic nature of computers makes it necessary to define exactly the form in which information is recorded on tape and to ensure that the actual records on the tape conform to these formats.

(i) Documentation

The groups at Woodstock and Aldermaston use search programs provided by CAS; those at Newcastle and Nottingham use programs of their own. In the former case it is useful, and in the latter vital, that accurate documentation of tape formats is available. All four groups report deficiencies in this area and have, in general, had to interpret and modify the format documentation in the light of actual experience. Though this is possible (though unnecessarily time consuming), it is not possible to deal effectively with unannounced format changes; at least one such change has been perpetrated by CAS without advance warning though fortunately without too serious consequences.

(ii) Quality Control

All four groups have experienced problems due to format errors. The Newcastle group report that 10 per cent of tapes received from MEDLARS have format errors; Woodstock and Aldermaston found issues 21–23 of CT (1967) completely unreadable, possibly for this reason. The Unit has records of three cases in 1967 and one in 1968 of tapes with serious format errors. The 1968 case was a CBAC tape which was returned to Columbus for replacement; the replacement tape was also in error. The Unit analysed the tape, discovered the faults, and returned the tape, with a diagnosis of the fault, to CAS. After some delay a further replacement tape was received; this had exactly the same faults as the previous ones and at the time of writing we are still not able to process this issue.

Conclusions

The conclusion that must be drawn from the experience of the Unit and the groups at Woodstock, Newcastle and Aldermaston, is that operators of computer-based retrieval services which rely on externally-generated tapes must anticipate a proportion of tape errors. How can the effects of these errors be minimized and where does the responsibility for doing this lie?

My personal view is that the main burden of responsibility for tape quality control must lie with the originators of the tapes but that, in return for greater effort by the generators of the tapes, the users must also play their part. The actions which need to be taken by the two parties are:

(*a*) By the originators of the tapes.

(*i*) Users must be provided with up-to-date, accurate and comprehensive documentation of tape formats.

(*ii*) Changes in tape formats must be notified to users well in advance of their implementation; in the case of users with their own search programs a minimum of one month's notice is essential.

(*iii*) Prior to despatch tapes should be checked for validity. At its simplest this involves checks for the presence of a valid header label and a valid end-of-file indication and parity checks. Ideally all tapes should be validated by an appropriate format-checking program before despatch; most users would, I believe, be prepared to pay a little extra for the tapes if this were done.

(*iv*) The user should be alerted (e.g. by Telex) immediately the tape is despatched so that he can anticipate arrival and take appropriate action (e.g. by rescheduling computer runs) if a shipping delay appears likely.

(*v*) The user should be alerted to production difficulties as soon as it appears likely that these will delay arrival of the tape by more than two to three days.

(*vi*) In the event that, despite these actions, an invalid tape is despatched, or a tape is unduly delayed, every effort should be made to replace the tape by another valid tape in a reasonable time.

(*b*) By the users of the tapes:

(*i*) The user should acknowledge receipt of the tape by recording the date of receipt and comment, where appropriate, on damage to the tape or its packaging and on unusual delay in receipt.

(*ii*) Should the tape appear to be in error the user should first assure himself that the error could not have arisen due to improper operation of the programs used, or, if he uses his own programs, to program errors. In the event that he can find no reason for failure he should provide the originators of the tape with as complete a description of the fault as possible.

(*iii*) Users must be constantly aware of the possibility that the computer or the programs which they use may be deficient in some way and take reasonable steps to ensure that failures are not due to this.

(*iv*) Users who use their own programs should recognize the possibility that despite all the checks proposed in (*a*) it may still happen that invalid tapes may get through and should program accordingly. In particular a program which can produce a print-out of the contents of the suspect tape is vital.

Action by both parties on these lines will significantly increase the likelihood of trouble-free operation. For some months now the Unit and CAS have been following a policy based on these lines. Though problems have arisen they have been of a minor nature and in every case it has been possible for the Unit to reschedule the computer operations to minimize the effects.

CT

Issue Number	*Run Due Date*	*Tape Arrived*		*Interval between Arrival of Tape and Run*	
		Date	*Day of Week*	*Early*	*Late*
1	6 January	2 January	Tuesday	4	—
2	20 January	15 January	Monday	5	—
3	3 February	26 January	Friday	8	—

4	17 February	9 February	Friday	8	—
5	2 March	21 February	Wednesday	10	—
6	16 March	8 March	Friday	8	—
7	30 March	22 March	Friday	8	—
8	13 April	2 April	Tuesday	11	—
9	27 April	30 April	Tuesday	—	3
10	11 May	4 June	Tuesday	—	24
11	25 May	15 May	Wednesday	10	—
12	8 June	31 May	Friday	8	—
13	22 June	17 June	Monday	5	—
14	6 July	8 July	Monday	—	2
15	20 July	16 July	Tuesday	4	—
CBAC					
1	13 January	5 January	Friday	8	—
2	27 January	18 January	Thursday	9	—
3	10 February	1 February	Thursday	9	—
4	24 February	12 February	Monday	12	—
5	9 March	15 March	Friday	—	6
6	23 March	25 March	Monday	—	2
7	6 April	29 March	Friday	8	—
8	20 April	17 April	Wednesday	3	—
9	4 May	23 April	Tuesday	11	—
10	18 May	28 May	Tuesday	—	10
11	1 June	20 May	Monday	12	—
12	15 June	7 June	Friday	8	—
13	29 June	20 June	Thursday	9	—
14	13 July	2 July	Tuesday	11	—

TABLE 1.—*Pattern of arrival of CT and CBAC Tapes at Nottingham,* 1 *January–*20 *July* 1968.

Acknowledgments

I am grateful to Miss E. D. Barraclough (MEDLARS), Mr L. Corbett (Aldermaston) and Mr P. J. Gallagher (Woodstock) for providing me with most useful information about their experience with CAS and MEDLARS tapes, and to Chemical Abstracts Service, and particularly Mr Don Sears, for their patient understanding of our problems and their willingness to seek ways of eliminating them.

DISCUSSION

Mr A. C. Bubb (Salford University) asked whether Dr Pflug had compared costs at Bochum with those in British or American university libraries, since no other German university library was giving a similar service. He also wondered whether Dr Pflug would advocate close examination of procedures to determine whether they were necessary, before embarking on mechanization.

Dr Pflug said that it was important to examine first the best way of using a computer and only to calculate costs after the system had been optimized. He did not think it practicable to compare costs in overseas universities with those at Bochum.

Mr P. Clague (Institution of Electrical Engineers) commented firstly on the difficulty of comparing SDI systems for which only precision figures were quoted, as these could be quite meaningless on their own. Secondly, with regard to the SDI system that was being set up as part of INSPEC, users had not been allowed to compile their own profiles, because the success with which they might be able to do this was not a parameter to be measured in the experiment. The users, were, however, closely involved in providing data on their interests and evaluating the output.

Mr East mentioned that often it was possible to learn more about user needs in the course of profile compilation than by other means.

Dr Kent said that his project it had been essential to arrange interaction with users in order to get them involved in the work. The fact that users had to pay a fee had also been conducive to good co-operation in that this made them keen to get value for their money.

Mr R. G. Groeger (John Laing) asked the speakers to comment on the potential use of Optical Character Recognition (OCR) in generating input instead of using punched tape or cards. In particular he would be interested in their views on the use of the OCR B font. Were efforts being made to persuade publishers to use this, especially for abstracts journals?

Dr Pflug replied that work at Bochum had only led them to a preference for tape rather than cards. He would prefer eventually to use direct recording on magnetic tape.

Dr Kent considered that there was a case for using OCR if author abstracts could be used as direct input, but in most cases this would not include any provision for other intellectual input such as keywords.

The Chairman, Dr H. Coblans, said that OCR had been considered for input to the INIS system, but manufacturers had not been encouraging with regard to its immediate use. The situation might well change, however, within the next four to five years.

Mr B. T Stern (The Wellcome Foundation) asked for comments on the use of programs supplied by agencies which issued magnetic tapes.

Dr Kent replied that the American Chemical Society did not recommend the use of such programs unless it was impossible to write one's own. Such programs tended to be so generalized that they were expensive to run. It was often more useful to share programs compiled by other users.

Mr P. D. J. Rae (IBM (UK) Ltd), commented that to use OCR it would be necessary to employ not only a standard font but also a standard title page lay-out. As a user of an SDI system he agreed with Mr East's statement on the importance of good back-up service. In his own experience he could obtain a microfiche copy of any IBM document he requested by return of post (from the IBM Laboratories in France). Mr Rae also wondered whether the American Chemical Society made any routine checks on the quality of their tapes.

Mr D. Newcombe (British Standards Institution) pointed out that some of the problems that had been mentioned could be eased by standardization. ISO had for some years been considering a draft proposal for the standardization of title pages, which had been converted into a draft British Standard and circulated for comment in the UK. Other aspects had been or could be considered either by the BS Committee for Mechanized Information Retrieval or by the Committee for Data Processing, or by their corresponding ISO committees.

Dr Kent commented that it was necessary to learn much more about systems before standards were adopted.

Miss H. M. Townley (International Data Highways) said that a recent simulation of a weighted-term SDI system had indicated appreciable difficulties in establishing what should be the threshold (the value to be met before a document was selected). The test had shown that a decrease of the order of 30 per cent of the threshold was necessary before there was any significant increase in the number of documents selected, and conversely an increase of 30 per cent before there was any decrease in the number selected. One's immediate reaction was against the use of weighted terms. Had anyone had any similar experience or contradictory evidence?

Mr N. L. Angel (Shell Research Limited) had seen references to the UK Consortium of Chemical Information and asked whether this had any relevance to the development of Dr Kent's work.

Mr Fairbairn replied that this Consortium had no direct relation to Dr Kent's work, but was attempting to bring together all the societies and organizations concerned with chemical information.

Mr D. Batty (College of Librarianship, Wales) suggested that the use of OCR devices to read title pages would be an unnecessary step, when it was possible to look forward to direct input from the publisher. Books and papers were in any case primarily for people to read, and often relied on special layout for their effect. The Library of Congress was already using OCR but only to read minimal numerical data on preliminary cataloguing forms.

Letter to the Editor

PRODUCT ANALYSIS BY COORDINATE INDEX

Dear Sir,

In his article (*Aslib Proc.,* March 1968), Mr G. H. Hutton gives an interesting example of the specificity of information sought by consumers (architects and designers) in the building industry. He writes (p. 172): 'Suppose, however, that a designer required to know which manufacturers supplied a metal window of the following description:

TYPE:	double hung vertical sliding sash;
SIZE:	5 ft. 8 in. × 4 ft. 0 in. wide;
MATERIAL:	aluminium alloy HE9;
FINISH:	satin anodised to grade AA35 to BS1615 : 1961 with strippable lacquer protection;
OPERATION:	gear-operated with plastic-coated operating handle;
GLAZING:	suitable for sealed double glazing units.'

He further observes: 'This description is neither exhaustive nor unusual in its requirements and yet none of the publications or authorities mentioned, no classification in common use and no catalogue distribution service could readily supply the name (if any) of manufacturers producing such a window'.

Work on the design of a freely faceted analytico-synthetic scheme for the depth classification of micro subjects has been in progress in the DRTC since 1964. The methodology for the design of such schemes was developed by Dr S. R. Ranganathan in 1963.[5] A step-wise procedure for the construction of the schedules has been detailed by Neelameghan, Gopinath, and Denton.[3] It is possible to classify coextensively subjects of great intention as mentioned by Mr Hutton with this newly developed depth version of the Colon Classification. For illustration, let us take the following example from a scheme for the classification of subjects in the field of Motor Vehicle Production[3]:

D8,93C1–(F=Z–66)–ZwB26–ZsH42=5–ZsB57=5–Zr15=5–Zn5=1Zm6=5–Zk4=1–X1–S112A48–P137A30–N9=1–L6–JV60–H211–G2=33–CHZ=381VT–CD9B1=1–CB66–BK–BCB–BC1–770 (2–zWR–z52)–710 (zWR–zS6–zS2)–zL9=7–zH4=1–zG4=9–zC–zB4=5–z95–zz6=7A13–zxE–zv–zu4–zt3=346–zsE1zsD1=412–zsC2=414–zsB3=163–zq2–zmB–zkF–zk1–zhB=B–zaB9–w5–u16=5–t20=6–r4=75–pJ36–kZG–kVR–kVJ–kVG–kV5–kRO (N9=91–D139)–kQO (N9=63–D214)–aR15–a1H24–a1B24 *where*

D8, 93C1–	MOTOR CAR;
(F=Z=66)–	BRAND: Ford Zephyr 1966;
ZwB26–ZsH42=5–ZsB57=5–	WEIGHT: Kerb weight 26 cwt, Weight distribution on rear axle 42.5 per cent, Weight distribution on front axle 57.5 per cent;

Zr15=5–Zn5=1–Zm6=5–Zk4=1–	DIMENSION: Overall length 15 ft. 5 in., Overall width 5 ft. 1 in., Ground clearance 6.5 in., Overall height 4 ft. 1 in.;
X1–S112A48–P137A30–N9=1–L6–JV60–H211–G2=33–CHZ=381VT–CD9B1=1–CB66–BK–BCB–BC1–	ENGINE: Petrol engine, Maximum power 112 b.h.p. at 4,800 r.p.m., Maximum torque 137 lb.-ft. per sec. at 3,000 r.p.m., Compression ratio 9.1, Cylinders 6, Cylinder arrangement V-type 60°, Displacement 211 cu. in., Stroke distance 2.33 in. per sec.; Carburettor: Zenith 381 VT brand, Choke diameter 1 ft. 1 in.; Fuel pump: AC operated; Combustion chamber: Toroidal; Valve gear: Overhead push-rod and rocker;
770 (2–zWr–zS2)–710 (zWR–zS6–zS25)	SUSPENSION: Rear: Independent, Cylindrical helical spring, Telescopic damper; Front: Cylindrical helical spring, Anti-roll bar, Coaxial telescopic damper;
zL9=7–zH4=1–zG4=9–zC–zB4=5–z95–zz6=7A13–	WHEEL: Wheel base 9 ft. 7 in., Track: Rear 4 ft. 1 in.; Front: 4 ft. 9 in.; Rim: Pressed steel disc, Width 4 ft. 5 in., 5-stud fixing; Tyre size: 6.70–13;
zxE–zv–zu4–zt3=346–zsE1–zsD1=412–zsC2=414–zsB3=163–zq2–zmB–zkF–zk1–zhB=B–zaB9–	TRANSMISSION: Gearbox: Synchromesh type, Reverse speed, Forward speed 4; Gear ratio: Reverse 3 346 to 1, Top 1 to 1, Third 1.412 to 1, Second 2.144 to 1, First 3.163 to 1; Final drive: Double arm; Rear axle: Sprung; Shift: Manual, Hydrostatic; Clutch: Borg and Beck; Engagement: Diaphragm, Diameter 9 in.;
w5–u16=5–t20=6–r4=75–pJ36–	STEERING: Recirculating ball and nut, Steering wheel diameter 16.5 in., Gear ratio 20.6 to 1; Number of turning circles lock-to-lock 4.75, Diameter of turning circles between kerbs 36 ft.;
kZG–kVR–kVJ–kVG–kV5–kRo (N9=91–D139)–kQO (N9=63–D214)–	BRAKE: Girling, Hand assistance, Servo, vacuum, Hydraulic; Rear brake: Disc diameter 9.91 in., Swept area 139 sq. in.; Front brake: Disc diameter 9.63 in.; Swept area 214 sq. in.;
aR15–a1H24–a1B24	MAINTENANCE FACTOR: Fuel tank capacity 15 Imp. gallons; Tyre pressure: Normal driving: Rear 24 p.s.i., Front 24 p.s.i.

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About seventy such depth versions of the Colon Classification for the classification of subjects going with different Basic Subjects—particularly in the field of Commodity Production Engineering—have been constructed so far. Some of these have been published in the quarterly *Library science with a slant to documentation* (1964–) and the volumes of the papers and proceedings of the Annual DRTC Seminar (1963–).

It has also been shown that the Feature Heading derived on the basis of a coextensive class number through the use of the Chain Procedure expresses almost all the relevant isolate ideas incident in the subject classified. Such a Feature Heading can serve as an indicative abstract.[1, 4] Neelameghan and Bhattacharyya have suggested a method for deriving Class Index Entries with the help of the Chain Procedure for micro subjects.[2] The Class Index Entries so derived provide for the approach of the reader by the name, in the natural language, of any one of the components of the Class Number.

In an experiment on computer-based document retrieval systems, the use of the freely faceted depth version of the Colon Classification has shown great potentiality. A series of reports on the first round of experiments will appear in the December 1968 issue of the *Library science with a slant to documentation.*

Yours sincerely,

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Automatisiertes Informations–und Dokumentationssystem (AIDS). [Automated information and documentation system (AIDS).] *ZIID Zeitschrift,* vol.15, no.4, August 1968, p.164–9. Describes the AIDS system, explains the principles and structure of the system in Czechoslovakia.

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Elektronik in Bibliotheken und Kritik. [Electronics in libraries and criticism.] *Biblos,* vol.17, no.3, 1968, p.188–215. A critical examination of reviews of works (including one by the author) on library automation, and of reports on current projects.

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Issledovanie vremeni, zatrachivaemogo na informatsionnye protsessy v NII i KB. [Investigation of time spent on information processes in Rand and design establishments.] *Nauchno-Tekhnicheskaya Informatsiya,* seriya 1, no.7, 1968, p.11–14. Cites data on time spent by R and D project staff on information processes and offers suggestions for improvement.

MEMBERS' ADVERTISEMENTS

Acceptance of advertisements for publication in Proceedings *does not imply Aslib support for or endorsement of the goods or services advertised.*

The charge for advertisements in these columns is 4*d* per word, minimum 5*s*. An additional charge of 6*d* is made for the use of a box number.

AUTHORITATIVE TECHNICAL TRANSLATIONS from French, German, and Dutch into English and from English, French and German into Dutch, specialities electronics, optics, instruments, photography. API Ltd, director K. S. Ankersmit, FIL (French, German, English), 19 Godstone Road, Purley, Surrey. BYWood 3781.

TECHNICAL SWEDISH, DANISH, NORWEGIAN translated by J. T. Craddock, B COM, FIL, Ekard, Ray Park Avenue, Maidenhead, Berks. Maidenhead 24931.

RUSSIAN/ENGLISH TRANSLATIONS. Chemistry, electronics, mechanical engineering. Twenty years' experience Government Department. A. de Merindol, 19 Ingelow House, Kensington, W8. 01-937 6788.

WILFRED E. GOODAY, ARSM, DIC, C.ENG, MIMM, FIL. Member of Translators' Guild, Romanian and French. 161 Rivermead Court, London SW6. RENown 1912.

MEDICAL, PHARMACEUTICAL, BIOLOGICAL translations from French, Rumanian and Portuguese into English and from English into French and Rumanian. Dr J. Jacobson, 94 Temple Fortune Lane, NW11. 01-455 1010.

TECHNICAL TRANSLATIONS from Russian, German and Polish into English. B. Klipstein, B SC(HONS), 1 Glenview Grove, Shipley, Yorkshire. Tel. Shipley 58215.

TECHNICAL AND COMMERCIAL translations from English into Russian. Mrs O. Linsley, 31 Parke Road, Barnes, London SW13. Tel. 01-748 8822.

TRANSLATIONS FROM TURKISH. All subjects. F. P. Scott, 4 Uphill Grove, Mill Hill, London NW7.

RUSSIAN TO ENGLISH TRANSLATIONS. Physical sciences, all industries. Fast service. Ceramics and high temperatures specialities. Kenneth Shaw, c/o CIS Ltd, Churston End, Copythorne Road, Brixham, Devon. Tel. Brixham 3221.

TRANSLATIONS: TECHNICAL, SCIENTIFIC, all west-European languages. J. Smuts, B SC (ENGINEERING), FIL, 12 Thorndene Avenue, London N11. Tel. 01-360 7723.

TECHNICAL OR COMMERCIAL translations into/from English, German, Dutch and French. A. M. H. Speller, FIL, NGV, 6 Lakeside, West Ealing, London W13. Tel. 01-998 1045.

TECHNICAL TRANSLATIONS. Spanish, French, German. Typescript, camera copy, direct image plates. E. W. Sykes, FIL, 39 West Close, Wembley Park, Middlesex. ARNold 4273.

COMPETENT commercial and technical translations from/into German and English. M. G. Young, FIL, 9 Osborne Road, Enfield. 01-804 4366.

Appointments vacant

INFORMATION OFFICER. The British Coal Utilisation Research Association invites applications for the post of Information Officer. Among his main duties will be to build up the bibliographic storage and retrieval system so as to provide an information service to the Association's research staff and to industry, to provide an SDI service to staff, and to deal with inquiries. He will also be expected to control the small but expanding industrial library and its staff. Candidates would be expected to have a sound technological background and to have had some experience of technical library and information work. Membership of the Institute of Information Scientists would be an advantage. Depending on age, qualifications and experience, the starting salary could be up to £1,800 p.a. Apply for Application Form to the Assistant Secretary, Ref. J.35, BCURA, Randalls Road, Leatherhead, Surrey.

COLLEGE OF LIBRARIANSHIP, WALES. Principal: F. N. Hogg, DPA, FLA. APPLICATIONS are invited from CHARTERED LIBRARIANS (a degree would be considered an additional advantage) for two posts of TUTOR-LIBRARIAN. The persons appointed would be required to administer the work of the College Library in the areas of acquisitions and cataloguing, and of reader services. Salary: on the scale for Lecturer II £1,725–£2,280. The planning of a new College Library is in progress and building is expected to commence shortly. Applications, stating name, address, age, education, qualifications, experience, present post and salary, and the names of three referees should be sent to the Registrar (from whom further details may be obtained) at the College of Librarianship, Wales, Llanbadarn Fawr, Aberystwyth. (Tel.: 3842.)

THE HOSIERY AND ALLIED TRADES RESEARCH ASSOCIATION. A suitably qualified person is required to help with the production and indexing of *Hosiery Abstracts* and to take part in the general running of an information service for the hosiery and knitting industries. Candidates should be graduated in science or technology with a reading knowledge of at least one foreign language, preferably German, and an ability to write clear English. Previous library or abstracting experience not essential. Applications in to: The Secretary, HATRA, 7 Gregory Boulevard, Nottingham.

INFORMATION OFFICER required by ISMA Ltd (the trade association of the World Phosphate Fertiliser Industry) to fill a newly created post within London-based secretariat. The person appointed will be required to take charge of a modest existing collection of technical and commercial literature, and to develop a suitable indexing system for this. The principal duties of this post, however, will be to provide an information service for ISMA members and professional staff, and to assume partial editorial responsibility for one of the periodicals published by the Association.

A good knowledge of French is essential and a knowledge of the chemical industry, of agriculture, or of international trade is desirable. Some international travel may be necessary.

It is felt that this position will be of particular interest to a young person with some relevant experience, who would welcome the opportunity of using his (or her) initiative and professional skills in building up a really worthwhile information service. A first-class salary will be paid to secure and retain the services of a first-class person. There is a non-contributory pension scheme and luncheon vouchers are provided.

Applications stating qualifications, experience, age and present salary to the Secretary General, ISMA Ltd, 121 Gloucester Place, London W1.

ZAMBIA NATIONAL COUNCIL FOR SCIENTIFIC RESEARCH. Applications are invited for appointment to the post of DOCUMENTATION OFFICER of the National Council for Scientific Research of Zambia. The person appointed will establish and maintain a centre for the collection and dissemination of scientific and technical information and research material. He will also be expected to train local documentalists. Applicants should preferably be scientists with documentation qualifications and experience. Salary range between K4,050 and K5,010 (K1 = 11*s* 8*d* sterling), initial salary depending on qualifications and experience. For Zambians there will be a superannuation scheme. Non-Zambians will be paid a contract allowance of K600 a year and a gratuity of 25 per cent of aggregate basic salary earned during resident service of not less than thirty months. Applications (six copies) giving personal details, qualifications and experience, and naming three referees, to be sent to the Secretary General, National Council for Scientific Research, P.O. Box RW.166, Ridgeway, Lusaka, Zambia, from whom further particulars may be obtained. Closing date 30th November 1968.

Wanted

ASLIB PROCEEDINGS August 1967. Full payment offered. City Librarian, City Library, Broad Street, Hereford.

HEAVY ORGANIC CHEMICALS DIVISION

ASSISTANT LIBRARIAN

For a person with appropriate experience and qualifications a vacancy exists in the Division Library. The work entails responsibility for a number of clerical staff engaged on inter-library lending, ordering publications, and general administrative duties. Computerised systems are being introduced and the holder of the post would take an active part in their further development.

The Library is part of a section that provides a variety of specialised information services, and the post offers good prospects of promotion.

Pension Fund and Profit Sharing Schemes are in operation. If you are interested please write for an application form to:

Mr. G. W. Marshall,
Personnel Officer,
Heavy Organic Chemicals Division,
Imperial Chemical Industries Limited,
"R" Building,
Billingham, Tees-side.

LIBRARIAN

A vacancy has arisen for an experienced librarian to take charge of the Central Library of the Avon Rubber Company at Melksham, Wiltshire. Whilst chiefly concerned with technical and scientific subjects, the library also provides a service to the Group on many non-technical subjects. The librarian will, in particular, be responsible for the abstraction of current literature, carrying out literature surveys, maintaining contact with outside libraries and providing a technical information service within the Avon Group. It would be desirable, but not essential, for the applicant to have an understanding of a foreign language, e.g. German or Russian.

An appropriate salary will be offered according to qualifications, experience, etc. Please write giving full details, quoting reference PR.37, to: **Mrs. B. Ansell, Staff Personnel Officer, Avon Rubber Company Ltd., Melksham, Wilts.**

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CALCUTTA UNIV

ASLIB PROCEEDINGS

incorporating Aslib Information

Volume 20 **December 1968** **Number 12**

ASLIB CALENDAR 1969

January

TUE.14.	Midlands Branch, Birmingham.
WED.22.	Evening meeting at Aslib. The American scene—relative to information and documentation. 5 for 5.30 p.m.
WED.29.	Chemical Group evening meeting. Aslib research programme, by B. C. Vickery.

February

WED.12.	Scottish Branch meeting. Speaker: Mr L. J. Anthony, Assistant Director (Services), Aslib.
TUE.18.	Midlands Branch meeting: Cover-to-cover technical translations.

March

FRI.21–SAT.22.	Symposium: Accelerating innovation. Nottingham University, Lenton Hall.
TUE.25.	Midlands Branch annual general meeting. Birmingham.
WED.26.	Evening meeting at Aslib. Organizational aspects of information flow in technology, by Professor T. J. Allen. 5 for 5.30 p.m.
FRI.28.	Scottish Branch annual general meeting. Northern Branch annual general meeting.

April

FRI.11–SUN.13.	Aeronautical Group annual conference.
TUE.15–THU.17.	Chemical Group Conference: Commercial and marketing information.
WED.23.	Third Aslib Annual Lecture. Expert and layman in contemporary society; problems of function and communication, by the Baroness Wootton of Abinger.

September

SUN.21.	43rd Annual Conference, Coventry.

Course on Work with Maps

Maps present problems in many libraries and information departments. They are important sources of information but they require special treatment in cataloguing, indexing and acquisition, as well as special kinds of storage and conservation. Librarians and information officers are often not sufficiently familiar with the technicalities of maps to appreciate the problems. Aslib has prepared, in collaboration with the Map Curators' Group of the British Cartographic Society, a course on Work with Maps, which will be held at Aslib Headquarters from Monday 13th to Wednesday 15th January 1969. It is intended primarily for librarians and information officers who have to handle maps alongside other materials, but it is thought that it may also be useful for certain other people, such as map librarians in university geography departments. The fee for the course will be 12 gns. to members of Aslib or the British Cartographic Society. A full programme is enclosed in this issue, and application should be made to the Education Officer on the application form contained in it.

Chemical Group and ECMRA Joint Conference

Specialized conferences in documentation never seem to lack support nowadays, and the Joint Conference, run by the Chemical Group and ECMRA on 12th November, was no exception. Under the title of 'Commercial intelligence —the essential tool for market research', this Conference provided a useful forum for exchange of ideas between special librarians, information officers and market research specialists. Of the 210 delegates present, twenty-seven were from overseas. The Conference was held in London at Quaglino's, and these comfortable surroundings no doubt contributed to the success of the meeting.

In the morning session, Dr D. W. Hill of the Shirley Institute outlined the information services of a research association with particular reference to their value as a source of commercial intelligence. It was noted with interest that *World Textile Abstracts,* which is due to begin publication in January 1969, will include not only conventional abstracts from technical journals but also more ephemeral information culled from trade journals and other sources.

Mr R. Lees, Ministry of Technology, gave a paper on the work of industrial liaison centres with particular reference to their sources of information. This was followed by a paper by Mr F. L. A. Handovsky, of Esso Chemical S.A., describing as a case study the organization and activities of his market research information centre.

In the afternoon session, Mr B. N. P. Hutchesson, of B.P. Chemicals (UK) Ltd., described the information requirements of market research personnel at various stages of a project.

Two final papers dealt with statistics. Mr L. S. Adler, Chemical Industries Association, in introducing his paper on 'Current trends in government statistics', paid particular attention to the importance of presentation of statistical material. Miss H. G. Humphry described the historical background and current problems affecting the compilation of international chemical statistics by OECD, and made a plea for more feedback from users of these publications.

Automated Publishing Systems

The Advanced Study Institute on Automated Publishing Systems (Program Specifiication and Design), which is planned for September 1969, will be different from previous large conferences in two ways. Firstly, numbers will be restricted to about eighty participants so that everyone will get to know everyone else; informal discussions will be possible and only people engaged on software development, systems design or actual operations will be included.

Secondly, the Institute will spread over fourteen days, with morning and late afternoon seminars on ten days, leaving a sizeable mid-day break and the week-ends for recreation and for detailed personal discussions. The formal sessions will be divided between lectures on set topics and discussion seminars which the leaders will have preplanned to some extent. The emphasis will be on software, systems organization, and cover the whole field thoroughly without dealing, except where essential, with the characteristics of hardware. No purely commercial presentations are envisaged; those attending from manufacturers would be expected to act as substantially independent and responsible research and development scientists and engineers, although the Institute will want to have authenticated data on systems already installed and the operation of them. The conference language will be English; no simultaneous translation is envisaged.

Further information may be obtained from Mr C. J. Duncan, University of Newcastle upon Tyne, Computer Typesetting Research Project, 10 Eldon Place, NE1 7RU.

VDI Richtlinien

To augment its information services, the Ministry of Technology has acquired a complete set of *VDI Richtlinien.* This, they believe, is the only complete set to be held in a library in this country. An amendment service will ensure that the set is kept up to date.

In form, the nearest equivalent to the *VDI Richtlinien* is the *BSI Codes of Practice.* However, *Richtlinien* generally go into more detail and may in some fields include instructions to technical personnel on plant operation.

The Verein Deutscher Ingenieure (Association of German Engineers), having formerly taken a leading part in drawing up DIN Specifications (the German Engineering Standards), began issuing its *Richtlinien* about twenty years ago. The essential difference between *Richtlinien* and DIN Specifications today is that the former reflect the current state of the art, and are written in the form of recommendations, whereas the latter have the character of standards.

Copies of the *Richtlinien* (in German) are available to industry on loan from the Librarian, Ministry of Technology, Abell House, John Islip Street, London SW1 (attn. Mrs L. Meyer, Room 008. Tel.: 01-834 4422, Ext. 161.)

Techlink

Techlink is a new experimental service run by the Ministry of Technology. Its aim is to provide rapid selective communication of technical ideas, discoveries and information to potential users in industry.

Where possible each Techlink contains enough descriptive matter for the recipients to be able to make immediate use of a development without further reference. If this is not possible, a separate report-type announcement is made, and in any case details of how further information can be obtained are given.

At present the Techlink service is being provided without charge on an experimental basis, through the Ministry's nine Regional Offices and the associated network of sixty-five Industrial Liaison Centres in Colleges of Technology. Users (mainly those in industry concerned with research, development and design) are asked to provide a profile of their technological interests broken down under fifty-two subject headings.

Techlink material is drawn directly from establishments and their report literature; work published in the journal literature is not normally included.

THE MICROFICHE FOUNDATION AND THE AVAILABILITY OF INFORMATION IN MICROFICHE FORM

L. J. VAN DER WOLK

Delft Technological University, The Netherlands

Paper presented at the 42nd Annual Conference, Canterbury, 22nd–25th September 1968

ONCE upon a time, in a nearby low country appropriately called The Netherlands, in a town well known for its antique beauty and called after its porcelain ware Delft, a couple of librarians with high ideals and a practical sense that heeded no beauty founded the Microfiche Foundation. They went to the local notary public, produced from their own pockets the money required for founding such an institution and had the pleasure of seeing their brainchild duly registered, after which the notary said his bill was exactly the amount of money on the table. So that the child started its career with the bare minimum of goods. And so it has always been. And if at the end of the journey it may look back at a fruitful life this will not be due to its riches, nor always to generous support, but to the belief and the perseverance of its followers.

According to its statutes the Microfiche Foundation has, of course, a Dutch name: Microkaart Stichting (*stichting* being foundation but *microkaart* not being microfiche). The explanation for this rather illogical fact is that at the time of its creation in 1954 the word microfiche as an internationally accepted English word did not exist. At that time we spoke of the microcard, which could be opaque or transparent. The opaque microcard was introduced into the library world by the forward-looking and imaginative Fremont Rider in his book *The scholar and the future of the research library* (1944). The book had a wide influence and microcards were produced in different kinds and by a variety of institutions. When, however, a similar thing, but transparent, as film sheet came into being the advantages were obvious. Easier reproduction, better image, smaller, so cheaper reading apparatus, and so on. There were several people experimenting in this field (Mr Tonnon and I described what we possibly could collect as evidence of this activity in *FID Publication No. 257* (1950)), but we may truly call Dr J. Goebel of Mainz (who for a long time now has lived in The Netherlands) the inventor, the father of the transparent microcard. But then your and our Mr H. R. Verry, the photographic expert of the British Treasury, objected to this word. A card in English could not be transparent, he said; that was a contradiction in terms. He then suggested borrowing the French word microfiche but pronouncing it the English way. We were only too happy to have hit upon this international-spirited solution and from that day on we have spoken of:

a microcard as an opaque flat microform,
and *a microfiche* as a transparent flat microform.

And that is why the Microkaart Stichting is now known internationally as the Microfiche Foundation.

Thus around 1954 there were three different microforms: the micro-rollfilm, the microcard and the microfiche. We felt that the first two got sufficient propaganda to be or to become known, but that the third one, the microfiche, in our eyes the best medium of the three for library and documentation purposes, did not get that help. That is the reason why we concentrated our efforts on promoting the use of the microfiche only.

Accordingly article 2 of the Statutes reads as follows:

> 'The object of the Foundation shall be to promote:
>
> *A.* the use of the microfiche;
>
> *B.* the technical development of the apparatus required for the manufacture and use of microfiches and whatever is connected therewith.
>
> The Foundation shall be of an idealistic nature and shall not be aimed at making a profit.'

In other words: the Foundation is a non-commercial, a non-profit-making organization. And though it is a foundation according to Dutch law, it is international in its activities and in the composition of its Board.

The Board is now composed as follows:

President:	Dr L. J. van der Wolk	Delft Technological University, The Netherlands.
Secretary:	Miss Theresa Hall	Delft Technological University, The Netherlands.
Treasurer:	Dr A. Gruijs	Nijmegen Catholic University, The Netherlands.
Members:	Mr L. L. Ardern	University of Strathclyde, Glasgow, Scotland.
	Prof. Dr J. L. de Brouwere	Royal Belgian Institute for the Natural Sciences, Brussels, Belgium.
	William R. Hawken	Consultant Document Reproduction, Berkeley, California, USA.
	G. Thiele	Institut für Dokumentationswesen, Frankfurt am Main, Germany.

Its activities at the moment are:

1 The publication of two periodicals, *viz.:*
   (*a*) the *MF Newsletter,* approximately four times a year and intended to reach everyone interested in the subject, and
   (*b*) the *MF News Note,* sent to the Foundation's national correspondents only.

2 The publication of a series of booklets, called with little imagination *Microfiche publication* no. 1, 2, 3, etc. The following have been published so far:
   No. 1. *Studying with microfiche;* 2nd rev. ed., by Dr L. J. van der Wolk. $0.50.
   No. 2. *Microfiche for the research worker,* by Dr L. J. van der Wolk. $0.50.
   No. 3. *Various applications of the microfiche,* by Dr L. J. van der Wolk. $0.50.
   No. 4. *Bibliography on microfiche,* by B. P. E. M. Bijmans. $0.50.
   *No. 5. *Microfiche equipment,* by N. Brantley and S. Hansen. $1.
   No. 6. *Supplement to bibliography on microfiche,* by H. F. Peeters-Houterman. $0.50.
   *No. 7. *Microfiche services in libraries,* by J. H. I. de Bruin. $0.50.
   No. 8. *Literature in microfiche form commercially available,* by J. H. I. de Bruin. $0.50.
   No. 9. *Supplement 2 to Bibliography on microfiche,* by H. F. Peeters-Houterman. $0.50.

* Only available either on microfiche ($0.50) or Xerox copy (±Dfls. 10).

The following titles will appear in the near future:

No. 10. *Microfiche equipment* (revised edition), by J. H. I. de Bruin. $1.
No. 11. *Microfiche services in libraries* (revised edition).

3 The maintaining of a kind of showroom of readers for microfiche, which for demonstration purposes are put at the Foundation's disposal by their manufacturers. This permanent exhibition is of great help to the many visitors to the Foundation's bureau in choosing a reader away from a certain pressure by a salesman. At the moment fourteen readers of the latest construction are on exhibition.

4 The giving of information and advice by word and by letter to visitors and interested people from afar.

5 The arranging of exhibitions on the microfiche and its use to accompany conferences, seminars, etc., or as part of larger exhibitions on reprography or other subjects.

6 To act in the interest of the microfiche by pleading for greater standardization, lower-priced readers and reader-printers, more automated production machines, and so on.

7 To take initiative in organizing information projects in which microfiche has or may have a function, for instance:

  (*a*) the co-ordination of the efforts of microfiche-supplying libraries and similar institutions;
  (*b*) the establishing of an organization that publishes abstracts of European dissertations and supplies microfiches of these dissertations.

Being a foundation and not an association, the Microfiche Foundation is not financed by its membership fees. Money may, however, be donated to it. Subscriptions to the Foundation's publications ($5 a year) are, however, the principal source of its income.

So far with the first part of the official title of my paper. And now the second part, 'the availability of information in microfiche form', to which in the advance programme an unknown helpful soul has added 'including up-to-date methods of microfiche production, duplicating and hard-copy production'.

Information in microfiche form can be distinguished in two ways:

1. *Information* supplied in one copy only to one applicant, present, for instance, in a library. The library, instead of giving a book or an article, gives a microfiche. The applicant pays for that service and becomes the owner of the microfiche and the information contained in it. In this way he builds up his own private information file, or documentation, call it what you will.

Publication no. 7 of the Microfiche Foundation gives the names and addresses of libraries and related institutions willing to give their clients this service. I have mentioned already that the Foundation now is busy forging these libraries together into a working group, with the aim of bringing the different practices of, for instance, method of payment and time of delivery into line with each other. It is also trying to promote the acceptance of standards as to the format of the fiche, the grid, the number of exposures per fiche and the price of the fiche. Applicants certainly would benefit from an agreement on all these points.

The new edition of this booklet, which will be no. 11 in the series, contains about sixty-five addresses, opposed to fifty in the first edition. However, this is still not a very great number when one thinks of the many libraries that could join this most helpful scheme.

When one considers that through a combined use of telex as a means of communication, and of microfiche as an easily airmailed and transported document, one can have any information from any library anywhere in the world in less than a week, it is clear that this project deserves our full support.

2. *Publication* or republication of a manuscript, or paper already printed, in the form of a microfiche. This is publishing rather than library's service. The publisher can, of course, be a commercial publisher or an institutional (in general non-profit-making) publisher. The publication can be ordered by anyone when he thinks he can make good use of it, but it is not made specially for him, as in the first case.

This form of information in microfiche form is what Dr Goebel had in mind when he developed the system. It is well described in the book that he wrote together with Professor C.H. Kleukens in 1940, entitled *Schrift, Letter, Mikrokopie* (Writing, letter, microreproduction).

In 1959 when speaking in Hatfield in a symposium on 'Microtexts as media for publication' I summarized the publishers that at that time had publishing on microfiche on their programme. The situation is different nowadays. More especially because of the huge publishing programme of American giants like DOD (Department of Defense), NASA (National Aeronautics and Space Administration), AEC (Atomic Energy Commission) and several others. It is indeed the discovery of microfiche by these institutions around the year 1962 that completely changed the face of the microfiche world. If the microfiche business had been up to that time more or less a European affair, with occasionally an American article (H.W. Ballou, C. Bishop, V.D. Tate, I.A. Wahrheit, R. Waldron), since that time the impulse comes from America and the Europeans make use of the favourable microfiche wind that is now blowing through the world. Because of American activity in the National Microfilm Association with its microfiche standards subcommittee standardization has made a step forward although the last word has not yet been spoken. Through the American efforts, automatic cameras, automatic developing, automatic enlarging and printing, new readers and reader-printers have come on to the market. Greater use of microfiche and increased production of microfiche make industrial development possible and on the reverse through industrial development use and production are stimulated. Instead of a vicious circle of low production, limited use, little commercial activity, we now have an upward spiral of large-scale production, greater use, more and more commercial interest. And we hope this upward trend will continue till perhaps a still better product has been developed, or till maybe greater automation requires quite a different approach. Of course, we should not cling to a system when a better one is possible.

Perhaps I should mention that there are kinds of flat, transparent microform other than microfiche. There is for instance the 35 × 60 mm Filmorex fiche, which can carry, besides the microtext, an optical coding in black and transparent spots for retrieval by automated techniques. Then there is the aperture card containing, in a 'window' on a normal punched card, a flat piece of microfilm usually about 4½ × 3½ cm. There are cards with apertures of various sizes or with several apertures on one card (Microseal). And you may also have a flat transparency of exactly the size of a whole punched card, 3.250 × 7.375 inches, a size which is already included in the American standard. There is furthermore the PCMI-card from NCR (National Cash Register) containing, on photochromic sheet film of the same standard size (105 × 148 mm) as the microfiche, a far greater number of images (2000–3200) in reductions up to 1:250, and even beyond.

Sizes and reduction ratios of these flat transparencies are clearly different from those of microfiche, for which the size, according to ISO-Recommendation R193, is either 105 × 148 mm (nominally 4 × 6 inches; DIN A6) or 75 × 125 mm (nominally 3 × 5 inches), while the reduction ratio is from 1:18 to 1:22 (BS 4187:1967), or not exceeding 1:20 or 1:24, depending on the grid chosen (NMA, M-1-1963)—say, normally about 1:18. Clearly we have not yet achieved the required international agreement on standards, which is a pity. The ways in which microfiche are made can be manifold, if only the result, the end-product, is a microfiche according to the standard.

The original way of producing a microfiche was by means of a step-and-repeat camera. This was the method Professor van Iterson of Delft developed in 1935, and the method Dr Goebel introduced in 1940. The images are photographed directly on to a flat piece of film of exactly microfiche size, row after row.

The Microcard Corporation does the same, but instead of having the sensitive film material as separate sheets it feeds the camera with a roll of film 105 mm wide, which is subsequently cut into pieces 105 × 148 mm long.

Another quite different way of building up a microfiche is by using 16-mm (or 35-mm) rollfilm, after which one can proceed as follows:

1 strips of rollfilm are fed into channels in a jacket of standard microfiche size;
2 the method, known as 'micro-folio', developed by Atlantic Microfilm Corp., whereby the strips are glued on to a transparent acetate sheet, again of standard microfiche size;
3 the method, developed by Atlas Delft, whereby the rollfilm, in a machine called the Unitizer, is printed on diazo microfiche material.

The first two methods retain the possibility of updating the microfiche, if all the places on the fiche have not been used. You merely add another strip. As this updating in many cases (for instance for hospital use) is desirable, and adds to the usefulness of the fiche, research is now being carried out in order to make possible the updating of a fiche not composed of strips, by just adding one or more single micro-images. There are three ways of doing this:

1 the familiar photographic way, by sensitizing the spot where the additional image is to appear and exposing that place;
2 the diazo way, using Kalvar film (the Midas-system from Caps, London). Development of this film is by heat, which makes selective development of parts possible;
3 the electrostatic way; in which the Xerox Research Centre is carrying out experiments.

Another interesting development lies in the introduction of automation in microfiche equipment. This is not surprising in a world where automation adds so much to the convenience and the possibilities of man. We may take it that automation will be introduced wherever human action and human thinking is unnecessary or even undesirable. There are at the moment microfiche cameras with automatic exposure control, automatic focus, automatic grid and row advance, automatic titling. The next step is an automatic camera-processor, an apparatus in which the microfiche after exposure is processed and dried, thus making expert photographic work and dark-room routine unnecessary. Houston Fearless, Fuji, and CNRS Paris have built prototypes. There are microfiche readers (Houston Fearless) with automatic selection and display of a desired page from a packet of microfiche, using keyboard selection or even computer command. There are machines (EL–3 and EL–4 from the Microcard Corporation, and the Xerox Microprinter) which enlarge pages from a microfiche completely automatically. (You just insert the fiche and dial the number of copies desired.) Finally we are awaiting news of research work being done at several places in the world aiming at connecting computer and microreproduction equipment. The second International Congress on Reprography (Cologne 1967) had several papers on this subject.

Bibliographic information on magnetic tape is becoming available in more and more scientific and technical fields, notably in the medical and chemical sectors. In the same way national bibliographies and individual library catalogues will be produced and offered for distribution. Modern techniques will enable librarians and information scientists to master the flood of information. But the presentation by that technical apparatus of the packet of information wanted by an individual scholar or engineer should be in a form that he can handle. In that process we want the microfiche to be considered as a useful intermediate.

The problem we have to solve is how to produce, store and use our knowledge. And the world is buzzing at the moment with ideas. It is not only a technical problem. Computer techniques, telecommunications and reprography may be able together to achieve whatever we need. But everything should have its place in a well-thought-out and internationally co-operative system that leaves no room for further separate local or individual side-tracks.

REPROGRAPHY APPLIED TO COMPUTER PRINT-OUT

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Paper presented at the 42nd Aslib Annual Conference, Canterbury, 22nd–25th September 1968

BEFORE discussing reprographic equipment which is specifically designed for computer print-out, it is as well to mention that investment in a simple document-copying machine for use in a computer installation may be worth while. Many computers are situated away from the centre of office services and generate and receive a fair amount of paper work which requires copying. Copiers of the electro-photographic type, suitable for intermittent use but nonetheless able to provide an A3 size copy for about 6*d*, are now becoming available and can be a valuable aid to making the odd copy of programs, flowcharts, correspondence, and so on.

There are three main groups of reprographic equipment which are of direct interest for computer print-out, namely, photocopying, duplicating and microcopying.

Photocopying

Although it is possible to make copies of tabulations, etc., on many types of photocopier, it is in the area of dyeline and xerography that specialist machinery has been developed.

(*a*) *Dyeline*

The *Azomatic* printer is an example of equipment designed to print one copy of each sheet of an unburst run of continuous stationery. The stationery is nicked at each fold and, during printing on to a continuous roll of semi-dry dyeline paper, a guillotine is operated by electrically sensing the nick to cut the prints, but not the stationery, into individual sheets. Maximum width is 18½ inches and maximum throw between cuts 21 inches. The speed of operation depends on the translucency of the continuous stationery (which preferably should be of a type designed for dyeline printing), the speed of the dyeline paper (and the faster the material, the weaker the image) and the length of throw between cuts. An 11-inch throw using the fastest materials will give an operating rate of four thousand prints an hour, no allowance in that figure being made for make-ready or reloading of paper. Price £4,399.

The *Azoflex* 4800 has a somewhat similar output potential, but operates from cut-sheet masters. It is a preferable type of machine if the continuous stationery has been burst and, particularly, if a variable number of prints are required from each sheet, since a pre-set counter will automatically allow delivery of between one and ninety-nine prints. Master change is automatic and the run required from successive masters can be preselected whilst the previous master is printing.

Maximum print size is 18 × 24 inches. Price £4,975.

Dyeline prints 11 × 18 inches cost around 2*d* each, excluding labour and overheads, and are invariably produced off-line.

(*b*) *Xerography*

The *Rank Xerox* 2400 *IV* is the only xerographic photocopier designed specifically for computer print-out. Its specification is close to the conventional 2400 or 3600 copier/duplicator in that multiple prints of an original are produced at the rate of 2,400 an hour on plain paper. The 2400 IV has the additional facilities of operating (only) from continuous stationery of a sheet size up to $15\frac{5}{16} \times 11$ inches and of reducing any original above $13 \times 8\frac{1}{2}$ inches to A4 ($11\frac{3}{4} \times 8\frac{1}{4}$ inches). Form outlines on translucent material can be overlaid in the copying area, thus avoiding the need to keep a wide range of different types of continuous stationery for use during the initial print-out. A collator of up to thirty stations (ten stations is standard) can be added to the delivery end. Rental terms for the 2400 IV are £350 a month plus ½*d* a copy meterage.

Duplicating

Photocopying methods are convenient in that they provide the quickest and easiest way of producing short runs of print-out material and for half a dozen or so copies are also economic. For longer runs, duplicating methods may be preferred on cost grounds.

To keep the cost to a minimum, the computer print-out equipment should produce the special master needed for the duplicator. Although it is possible to make both spirit and duplicating masters by this method, difficulties may arise in ensuring that all characters, particularly figures, reproduce clearly, and the preferred duplicating method today is generally offset litho.

Offset master material in fan-fold form, usually perforated for the appropriate sheet size, is printed by the tabulator using a reproducing ribbon. The offset master is then treated in an identical way to normal litho materials and as many copies as are required run off on the press. Since computer print-out is likely to be of a consistent size and run-length, the use of 'systems' offset machines can greatly reduce the time-absorbing make-ready aspect of offset litho and the process may be economically suitable for runs as low as six. There remains, however, the need for a certain amount of operator expertise to ensure the process works satisfactorily.

Microcopying

Microfilm can be of assistance in computer print-out in two ways:

(*a*) The paper print-out can be filmed, while still in continuous form, by a range of 16-mm cameras especially designed for the purpose. The aims may be threefold: to save about 95 per cent of the considerable space taken up by paper prints when the information on them needs to be retained; to generate further copies of the print-out via microfilm (see below), and to release expensive magnetic tapes, containing long-lived data, for immediate re-use. In the latter connection it may prove economic to print-out on paper, then to film and finally to destroy the paper copy rather than retain information on tapes where it may be difficult and expensive to retrieve by anything less than a full print-out.

The cameras designed for this work are mainly adaptations of the continuous-flow type and can usually accept stationery at least up to 18 inches wide. Some have in-built processing facilities for the film. All work at fairly high speed, are simple in operation and operate off-line.

(*b*) Microfilm can be generated direct from the computer output, usually off-line. The General Dynamics range of Stromberg Carlson computer recorders have the facility of translating coded data held on computer-generated tapes into graphs, maps, drawings, etc., and of displaying them on a CR tube, where they may be projected on to a 16-mm or 35-mm film, or indeed on to photocopying paper.

The 3M Company's Electron Beam Recorder converts computer-generated matter into character form but the electrons, instead of exciting the face of a CR tube, are directed at 16-mm microfilm held in a state of high vacuum. Projecting directly on to film achieves a very much higher degree both of resolution and of speed, up to twenty thousand lines/minute being possible. The film is of the dry-silver type and is processed within the equipment immediately following exposure to the electron beams. This method holds the possibility of achieving a rate of output from a computer at least approaching the rate of input and, in suitable cases, of avoiding the need to create any bulky 'hard copy'.

Microfilm so created can be handled in any of the conventional ways: it can be unitized in aperture cards, retained in roll form, stored in casettes and duplicated. It can be referred to on readers and eye-legible copy can be obtained from the wide range of reader/printers or, for high volumes, enlarger/printers such as the Xerox Copyflo machines. Dyeline intermediates and offset masters can be produced for mass printing requirements.

Other Methods

Finally, the use of tape-operated typewriters for print-out is worth consideration. These machines are widely used for producing the multiple-channel paper tapes required for computer input, but although comparatively slow for output (maximum speeds are about fourteen characters a second) their use may prove time and money saving for work which is eventually to be printed for wide distribution. Such work is often printed-out normally then sent to the printers for setting-up in type. This involves an additional slow, expensive operation with a risk of errors creeping in. If the output tapes are used on automatic typewriters, high-class camera-ready copy can immediately be created for subsequent offset-litho reproduction. Such typewriters are now available with coding compatible with most computers.

SHARED CATALOGUING : A NEW LOOK AT AN OLD PROBLEM

A. J. WELLS

Managing Editor, British National Bibliography

Paper presented at the 42nd Aslib Annual Conference, Canterbury, 22nd–25th September 1968

THE concept of shared cataloguing is by no means new. Library literature over the past 120 years is studded with attempts to show the wastefulness of individual cataloguing and the virtues of systems of shared cataloguing, called in the past centralized or co-operative cataloguing.

The first really significant step was taken in 1901 when Herbert Putnam, the recently appointed Librarian of Congress, described a plan for printing and distributing cards for titles added to the Library of Congress.

In 1947, after several years of discussion, the Farmington Plan was launched in the United States. Its primary object was to ensure that at least one copy of every new foreign book that might reasonably be expected to interest a research worker in the United States was acquired by an American library and promptly listed in the Union Catalog at the Library of Congress. The Plan relied on the voluntary co-operation of a large number of libraries and resulted in the decentralization, not only of the collections, but of cataloguing. It is interesting to note that, after twenty-four years of experience of the Farmington Plan based on decentralization, the Americans have changed their views entirely and have recently put in its place one of the largest operations for the central acquisition and cataloguing of books in the history of libraries.

Another major attempt to break through the problems of centralized cataloguing was undertaken by the Library of Congress in 1958. In that year, with the financial assistance of the Council on Library Resources, the Library of Congress carried out experiments to test the feasibility of providing cataloguing information in books themselves. The object of the experiment, known as 'Cataloging-in-source', was to enlist the co-operation of publishers who were invited to send printed proofs of their new books to the Library of Congress for pre-cataloguing—the cataloguing information then being printed on the verso of the title page. The advantages of this procedure, had it succeeded, are that it avoids the troublesome problem of matching books obtained from one source with cataloguing copy obtained from another, and ensures the current cataloguing of new books. Unfortunately, the publishing trade in America, as in this country, is not organized to operate a system of this kind and the project was abandoned.

In spite of the deficiencies of the Library of Congress printed card service—deficiencies which cataloging-in-source was designed partly to overcome—the Library of Congress has been distributing many millions of cards each year (nearly seventy-nine million in 1968) to some seventeen thousand libraries. Despite this prodigious figure, however, the larger academic and research libraries of the United States found that in recent years they were able to obtain catalogue copy from the Library of Congress for only between 35 per cent and 50 per cent of the titles added to their collections each year. At the same time these libraries are acquiring books in increasing numbers and spreading their purchases all over the world. The problem of obtaining competent staff to catalogue the increasing volume of titles with the necessary language skills was becoming unsurmountable. We might ask, as Grose and Line have recently done,[1] whether catalogues of these dimensions justify the large amount of skilled time expended on them or whether there is not some better way of providing the necessary bibliographical services to library users. But in 1963 American librarians, in spite of the fact that 16 per cent of their total budget was being expended in a partially ineffectual effort to provide extensive card catalogues, were 'in general agreement that it was necessary'.[2]

In that year the Association of Research Libraries of the United States set up a Shared Cataloging Committee to seek solutions to their cataloguing problems. As a result of their activities, the United States Congress was persuaded to introduce into the Higher Education Act of 1965 a provision, known as Title II C, authorizing the appropriation of sums of money on an unprecedented scale to be used by the Library of Congress for developing a comprehensive national cataloguing system. Briefly Title II C provides that the Library of Congress shall be authorized to become comprehensive on a world scale in acquiring currently published material of scholarly interest, and shall be charged with the duty of providing a bibliographic record for every title so acquired within three to four weeks by issuing a printed card or by some other means, for example, a machine-readable record.

This ambitious 'Shared Cataloging Program' was successfully launched in 1966 and by 1967 university and research libraries in the United States were claiming that they were able to obtain current cataloguing data from the Library of Congress for between 70 per cent and 80 per cent of their new purchases.

The Shared Cataloging Program has been described in detail elsewhere[3] and it is not my intention to do so here. Nevertheless there are features of the programme which are worth noting.

In the first place, there has been a swing in American thinking away from decentralization as it existed under the Farmington Plan to total centralization within the country. On the other hand, a degree of co-operation has been established between the Library of Congress and the bibliographical centres of many other countries which brings new meaning to the concept of shared cataloguing.

Faced with the task of acquiring a cataloguing force capable of handling an additional one thousand titles a week, the Library of Congress Processing Division, under the inspired leadership of John Cronin, conceived the idea of using the cataloguing data produced by the various national bibliographical centres themselves. For a number of reasons, the initial experiment to test the feasibility of this proposal was set up with the British National Bibliography. In 1966 the British National Bibliography began air-mailing to the Library of Congress—through the agency of the London office of Stevens and Brown—a duplicate of the printers' copy of entries about to appear in the weekly lists of the British National Bibliography. Only a small amount of editing of the information was carried out at the Library of Congress before using the copy to produce their regular printed catalogue cards. As a result, printed cards for all new British titles are available in the United States only a week or so after the publication of the books themselves. Following the success of this experiment, the Library of Congress set up a Bibliographical Office in London to do preliminary editing, to arrange for the immediate purchase and air transport of one copy of every title represented by a catalogue record and generally to control the operation.

By 1967 Bibliographical Offices had been established in London, Vienna, Wiesbaden, Oslo, Paris, Belgrade and The Hague and discussions have been taking place for the extension of the Program to other countries of Western and Eastern Europe, including the USSR.

The outstanding feature of this enterprise, to my mind, is the practical demonstration of the feasibility of using, for cataloguing purposes, the descriptions of publications listed in the national bibliographies of the countries concerned. In January 1966, at a conference in London attended by the national librarians and producers of the current national bibliographies of England, France, Germany and Norway, the Library of Congress showed, with numerous examples, the high degree of compatibility that existed between the descriptive entries in all the national bibliographies represented. This conference, I am sure, inspired our own Copyright Libraries to think again about the possibility of sharing the burden of cataloguing British books and, since that time, a working party of representatives of the Copyright Libraries and the British National Bibliography has been investigating the practical implications of using the descriptive entries compiled for the British National Bibliography in these libraries.

The history of shared cataloguing in Great Britain is nothing like so spectacular as in the United States. The main reason, I suppose, is that we have lacked the co-ordinating influence of a truly national library. Until comparatively recently the library of the British Museum has taken little part in the promotion of national bibliographical services with the result that such as we have—and some are highly efficient—have developed independently and very much in isolation. (It is remarkable that to this day there is still no standing committee at which the representatives of the various national bibliographical services meet.) It seems almost unbelievable that representatives of the six copyright libraries, all of whom catalogue more or less the total output of British publishing, met together for the first time ever in 1966. The meeting was occasioned by a suggestion from the British National Bibliography that the Copyright Libraries should formulate a common policy with regard to the Revised Anglo-American Cataloguing Rules and investigate ways in which the descriptive entry produced by the British National Bibliography could be utilized in all the libraries.

Centralized cataloguing in Great Britain effectively dates from 1950 when the British National Bibliography was established. The promoters of the national bibliography had declared their intention of publishing a bibliography in weekly list form only and had no immediate plans to provide a printed card service.

(In view of the fact that the organization created to run the national bibliography was set up as an independent self-supporting company with a capital of fifteen shillings, the limiting of its initial objectives is understandable!) The London firm of Harrods announced their intention of making good this omission and launched a printed card service in 1949. The service was withdrawn after a year owing to lack of support and pressure was put on the British National Bibliography to provide a substitute.

It was not until 1956 that the British National Bibliography had the resources to begin a service of printed cards. Because of certain limiting factors in the production processes, the service offered only a unit author entry and provided no tracings. The deficiencies of the services have been put as follows:[4]

1 The service, being limited to British publishing over the preceding ten years, covers only part of the cataloguing needs of a library.
2 The method of ordering, which involves searching the *British National Bibliography* for the card order number, is time consuming and involves a wasteful matching procedure.
3 The quality of reproduction is not of a high quality. (The process used to produce cards employs a fibre stencil.)
4 The cataloguing information is incomplete. The cards lack tracings and subject headings.
5 Because the BNB card service came into existence so late (1956) most libraries have already established cataloguing rules which produce entries and headings different from those used in the printed card.

In a recent investigation into the use of the services offered by the British National Bibliography,[5] Mr Peter Lewis showed that over 40 per cent of British public libraries are using the BNB printed card service in spite of its limitations. Friedman and Jeffreys in their survey of cataloguing in British university libraries[6] found that 'few university libraries made use of existing centralized cataloguing services'. The whole reason may well not be their 'reluctance to accept somebody else's cataloguing', but as Friedman and Jeffreys point out it has something to do with it. Attitudes of this kind must change and we must find a formula for a bibliographical description to which all libraries are prepared to subscribe if we are to continue compiling local catalogues in the face of the increasing gap between manpower and work-load.

Lewis found that a large but unspecified number of public libraries use the cataloguing information in the weekly lists of the British National Bibliography as a basis for their own cataloguing, and although this does not eliminate the clerical task of reproducing cards, nor entirely eliminate the professional task of cataloguing, it does allow for the editing of the cataloguing information to meet local variations.

The hindrances in the way of the effective use of centralized cataloguing services may be generalized as follows:

1 Lack of comprehensiveness
2 Lack of currency
3 The matching problem
4 Incompatibility

Fortunately, solutions to all of these seem much nearer today than ever before.

The Library of Congress has demonstrated with its Shared Cataloging Program the possibilities for extending the coverage of a central cataloguing agency and increasing its comprehensiveness. With characteristic generosity, the Library of Congress is willing to make available to any of the national bibliographical agencies co-operating in the Shared Cataloging Program the total output of cataloguing data produced. Judging from the experience of American libraries this could mean that between 70 per cent and 80 per cent of the cataloguing of current purchases of our university and research libraries could be met from an extended BNB service using the LC cataloguing data as a basis. The problem facing BNB, however, is to find a method of card reproduction which eliminates the massive card storage and retrieval operation endemic in the Library of Congress system.

The Library of Congress itself has recently mounted an investigation into a system for total automation of printed card production. The results of this are not likely to be available for some time and in any case the process, if attained, may involve a capital investment far beyond the means of the British National Bibliography. We ourselves are looking into a less sophisticated procedure which will take the cataloguing data from the MARC tape and automatically produce master stencils for card reproduction on an on-call basis similar to the present BNB system. Details of this have still to be tested (July 1968). It does seem likely, however, that in one form or another—a printed card or a machine-readable record—a comprehensive centralized cataloguing service could be available for current material to British libraries by 1970.

The problem of keeping up to date in the issuing of catalogue copy in any form is bound up with the acquisitions routines at the central cataloguing agency. The Library of Congress has gone to the expense of setting up local bibliographic offices and of purchasing a copy of new publications in each country to supplement, and at times to supersede, the work of the national bibliographical agency of the country concerned. As far as the currency of British cataloguing is concerned, the matter is entirely in the hands of the publishing trade. The British National Bibliography has very good relations with publishers, for it is, of course, in publishers interests to obtain a current entry in the weekly lists. But publishers could undoubtedly do better. Their feeling of injustice over the provisions of the Copyright Act occasionally leads them to mount an attack on the British National Bibliography, which relies on their generous interpretation of the Act to secure up-to-date recording. The British National Bibliography has recently (July 1968) been suffering the effects of 'minimum co-operation' by publishers who were endeavouring to air their displeasure at the provisions of the Copyright Act. Whatever the merits of their case, there is a clear need to settle the copyright issue once and for all and to ensure, by legislation, that the British National Bibliography has right of access to every new publication at the earliest possible moment.

The recent decision of the Publishers Association to sponsor Standard Book Numbering could have a beneficial effect on the currency of the British National Bibliography. As part of the plan to administer the scheme, a register of standard book numbers is to be compiled by the newly formed Agency for Standard Book Numbering (a subsidiary of J. Whitaker & Sons Limited).[7] It is intended that publishers should notify the Agency of their intention to publish a new title and register the standard book number assigned to that title with the Agency. The information should be registered four to six weeks before publication, and, as the British National Bibliography is being supplied with copies of the entries going into the register, it should be in a position to remind publishers to deposit promptly.

The standard book number scheme should also greatly assist in overcoming the problem of matching books purchased by a library with cataloguing data from the central cataloguing agency. For some 80 per cent of British publishing, standard book numbers will be publisher-generated. These publishers have been asked to print the number on the back of the title page and elsewhere on the book. They are being asked to give the standard book number as part of the regular bibliographic description of a book in all their pre- and post-publication publicity. The trade bibliography—*The Bookseller*—and the British National Bibliography will print the standard book number in their lists. The situation at which we must aim is one in which the standard book number, like the LC card number, is available to the librarian whenever he has a book or a description of a book in his hands. Already 50 per cent of British publishing is numbered and it is hoped to introduce total standard book numbering in 1969.

The problem of incompatibility between existing records in a library's catalogue and the cataloguing of the central agency is one which only the library itself can tackle. Perhaps we should not be too concerned about matching the amount or the order of the data-items contained in the two records. Some inconsistency in this respect does not seem to me to matter very much. Incompatibility of headings is, of course, more troublesome. One of the most encouraging discoveries that arose out of the investigations of the joint Copyright Libraries/BNB Working Party was that the extent of the differences in headings was far smaller than expected. We have tended, I think, to dwell on our differences and failed to notice the high degree of agreement. The British Museum, for example, has found it possible to use over 80 per cent of BNB cataloguing records for the Museum's General Catalogue. The reason probably is that those rules which give rise to differences in headings account for only a small number of instances. The great majority of headings are governed by common rules.

Descriptive cataloguing and the choice of author headings form only one part of the cataloguer's task. The more arduous task is the construction of the subject catalogue. Up to now the British National Bibliography's central cataloguing services have offered very little help in the way of subject cataloguing. However, as part of the BNB MARC Project, it is expected to provide a wide range of subject data in the form of: an LC class number; a DC seventeenth edition (or later) class number; LC subject headings; and an organized set of descriptors for machine-searching and machine-construction of an alphabetical index to a classified catalogue. Unfortunately, it will not be possible, under present circumstances, to include tracings of any kind on the printed cards, but ways of distributing this information with each batch of printed cards are being sought. Nevertheless, libraries buying cataloguing data in the form of printed cards, even an extended service including tracings and subject data, will be faced with the problem of incorporating the centrally produced data into existing catalogues.

The MARC record containing an extensive set of data for descriptive and subject cataloguing will be obtainable in machine-readable form from 1970 (hopefully). And it is clear that, provided we can find suitable ways of using the MARC record in the local library situation, questions of compatibility assume less importance. Many choices, where choices exist, could be completely machine controlled. The substitution and addition of local data will be simplified. Editing out unwanted data and supplying additional local data to a machine-readable record is undoubtedly easier and the MARC Project appears to open the way to local variations on central cataloguing data. Experience in the use of a machine-readable record is, however, severely limited and what type of catalogue services libraries may ultimately supply in a computer environment is a wide-open question. I must say that I stand somewhat appalled at the prospect of setting up in the libraries of Great Britain giant card catalogues on the scale of those of our American colleagues.

Perhaps, however, the greatest change we are likely to see in the sphere of shared cataloguing in the very near future will be a shift from nationally based systems to international interchange of cataloguing data by means of magnetic tape.

The value of the Library of Congress Shared Cataloging Program, as I have said, lies in the demonstration of the extent to which compatibility in essentials already exists. At the moment, in order to maintain reasonable currency—and also partly to ensure consistency in detail with the existing Library of Congress Cataloging System—the United States is shouldering an immense financial burden by maintaining its own bibliographical offices in most of the countries of Europe.

We should not rely on one country's determination and energy to provide us all with a supra-national bibliographical service, but rather we should regard the Library of Congress Shared Cataloging Program as an example of what we could achieve if we all made up our minds to improve our national bibliographical services and were prepared to modify and extend our procedures so that all could contribute to a common pool.

With the facility for transmitting data in machine readable form, and using the MARC format in which each data element is mapped and easily accessible, we could overcome the problem of communication between national bibliographical centres. We have only to solve what remains of the problems of currency of recording and of compatibility of procedures in each national bibliographical centre—and these problems are by no means as large today as they have been in the past. So much has already been done through IFLA, UNESCO and ISO to achieve standards for cataloguing and for machine compatibility, that what remains to be done is comparatively little.

Publishers everywhere are actively concerned with the creation of a standard identifier for a book and through their Standard Book Number they are about to provide us with the means for matching cataloguing data and books which, in spite of our own attempts through such devices as the LC card order number and the BNB serial number, has so far eluded us.

We ourselves are more aware than ever before of our inability to stand alone and of the losing battle we fight in trying to create and maintain our own individual catalogues. The time is now ripe therefore and the means are at our disposal for co-operation, not only within each country, but on an international scale which one hundred and twenty years ago was no more than a dream.

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COMPUTER-BASED INFORMATION SERVICES*

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Summary

COMPUTER-BASED information services covering major disciplines of science have been developed recently from certain traditional abstracting and indexing services. A wide range of secondary information services is provided to satisfy the various information requirements generated by the present complexity of scientific and technological work. This development has caused radical changes in the administration structure, pricing policies and funding of the organizations providing information services.

In an attempt to meet the increasing production and development costs and also to tap new sources of intellectual manpower, a number of information services have taken the first steps towards international information systems. The first stage is usually the introduction of an experimental service into a country. The initial cost to the country can be low and there is a simultaneous build-up of both commitment to the service and experience of its use. The low initial cost can help receiving countries to reach a decision to participate more readily and an increasing number of experimental services may be set up in this way. International organizations such as OECD can help to facilitate the spread of information services stimulating national action and by providing a forum for the exchange of experience of their use and development.

Thus current activities may lead to a more efficient international information system based on effective national information networks within individual countries. Both will develop more readily if there is one focus within a country with the responsibility of co-ordinating and developing all scientific and technical information activities. While most activity has occurred in major information services, similar developments can be expected in more specialized fields and in the future there may be a very wide range of computer-based information services available internationally. At that time the selection of the appropriate information service and its correct use will become more important and more attention to the education of both scientists and information officers will be necessary.

The evolution of information services

In the hundred or so years of their existence, abstracting services have developed to occupy an important role in the use of scientific and technological information. Some have developed more effectively than others and in each major discipline one or two have become accepted within each language group as the most important in view of their reliability, coverage, currency and accuracy. The need to learn about work in other countries has resulted in scientists and technologists learning to read the most important common languages so that a significant number of major abstracting services have been used widely for some time on an international scale. The providers of these abstracting services have a natural desire, in addition to any financial incentive, to retain their pre-eminence by improving their services to readers, and developments in these services during the past twenty years, when the output of scientific and technological information has increased so rapidly, have resulted in quite radical changes in the structure of the organizations.

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* The views expressed in this article are the authors and not necessarily those of his department.

Most abstracting services were started with a few dedicated scientists who devoted their spare time to abstracting primary papers for the benefit of other workers. This tradition exists today with many publications but, in view of the changing pattern of scientific life, it is not clear how long it can continue. Similarly this method of working is in conflict with the wish to improve currency in particular and, in the present situation of an 8 to 10 per cent exponential increase in the number of papers abstracted each year, many abstracting services have come to rely more and more on in-house abstractors. Thus large staffs are employed and it becomes more difficult for smaller abstracting services to provide the same level of service. Some major abstracting services have now become medium-sized businesses, a particular example being the Chemical Abstracts Service of the American Chemical Society. This organization was started in 1907 when approximately 8,000 abstracts were published. The first million abstracts required thirty-one years to be published, while the next two million required only twenty-five years. Sixty years after its foundation Chemical Abstracts Service employs a full-time staff of nearly one thousand and has an annual budget exceeding $12 million. Further details of this remarkable organization are given in a booklet *CAS today* published by the American Chemical Society in 1967 to mark the sixtieth anniversary.

The abstract publications themselves have changed: originally they were intended for personal subscriptions and use but the steadily increasing size and the consequent need for better indexes has resulted in subscriptions which are too high for most individuals. Furthermore, abstracting services have used computers to help deal with the present high levels of input but this work has not been easy and high development costs have been borne—often with Government aid. Thus, the US Government has provided Chemical Abstracts Service with more than $5 million to support its R & D operations since 1965. At the present time, it seems probable that this work will not result in cheaper abstract publications, and initially will only help to maintain the present level of services. As a part of their development work many abstracting services have experimented with new services, some of which were quicker than the traditional abstract publication, for instance using titles (e.g. Current Chemical Papers, Chemical Titles and BASIC), while others gave a much more specialized coverage (e.g. Chemical Biological Activities, Cerebrovascular Bibliography and Toxicity Bibliography, the last two both from MEDLARS). In this way the abstracting services have developed into what we understand today as discipllined-based information services. These provide individuals and organizations with a wide range of services varying in currency, coverage and content and the objective of the information services is to derive the complete range from the same machine-readable data base produced by processing each primary publication once only.

Factors restricting development of information services

It could be contended that the major information services were operating in ideal market situations with completely captive customers and therefore able to fix their own prices to cover both production and development costs. This may be true for those traditional abstracting publications which are rightly considered indispensable by scientists, but increasing production costs and consequent increases in price restrict the money available both from customers and the organization itself for experimentation with new services. The situation may be aggravated further by higher than average production costs in the United States, where many abstracting services originate. Perhaps the most important factor restricting the development of better information services is the conservatism of the average user of scientific information and a general lack of understanding of exactly how information is used. This is one important reason why the market situation for information is non-ideal, since considerable education of the potential customers is required before they will appreciate the virtues of the different services offered to them. Such education is expensive: perhaps more expensive than the development of computer-based information services, and it seems probable that no one country will be able to meet the full cost of both developing and promoting the use of these services on the same international scale as the abstracting publications are used. Even if money was available and the conservatism of scientists overcome, another important factor remains—the shortage of suitably qualified scientists and technologists to undertake the preparation and input to these systems, particularly in the United States.

The approach to international co-operation

Such problems are common to abstracting services irrespective of their parentage. This may vary from a Government library (MEDLARS) or laboratory (*Nuclear Science Abstracts*) to a learned society (Chemical Abstracts Service of the American Chemical Society) to a commercial organization (*Excerpta Medica*). Only in those areas of science where high expenditure is accepted, for instance in space research and atomic energy, have information services been developed with few restrictions. In an attempt to overcome their difficulties a few information services have sought to develop international use of their data bases through international agreements whereby some of the input costs may be met nationally. I believe the motivation for this approach is threefold: firstly to minimize the total cost and hence the subscription to users; secondly to increase the available manpower for the work of evaluating the primary literature, and thirdly to maximize the use of the service.

A common pattern of events is emerging in these early attempts to develop international agreements. So far government or learned society sponsored information services have been involved and the first approach, often to their opposite numbers in other countries, may originate either with the information service or with the country which wishes to improve its own information activities. The experience of this country with MEDLARS provides a good example. The first stage was informal discussions between the Director of the National Library of Medicine and various organizations (with an interest in information activities or medical research) such as the Ministry of Health, the Royal Society of Medicine, the Medical Research Council and DSIR. A unique feature was the involvement of a computer specialist, Professor E. S. Page of Newcastle University, who was keen to study the application of computers in a relatively new field. Experience of a computer-based information service did not exist in this country in 1964 and the experimental use of MEDLARS proposed by the National Library of Medicine would provide such experience at minimal expense. The experience gained should also be applicable to similar developments in other scientific fields and would provide a guide to the cost of operating these services. From these early discussions a scheme was devised to introduce MEDLARS on an experimental basis to this country whereby the computer work would be done at the University of Newcastle and the information/library work at the National Lending Library. The project was funded completely by Government, initially by DSIR and then by OSTI on its formation in April 1965.

After two years' experience of the system the decision was taken that the system should become permanent in this country. During this experimental period informal contact had been made with a number of other European countries and a second centre had been established on a similar basis at Stockholm. When the National Library of Medicine wished to make MEDLARS more widely available to European countries it was natural that they should look both to Stockholm and ourselves for help in introducing other users to the service. The approach to European users was made through the OECD Scientific and Technical Information Policy Group and discussions have been in progress for eighteen months.

The pattern of events for the introduction of Chemical Abstracts Service to this country was very similar and OSTI was involved in the early informal discussions between the American and British Chemical Societies. An experimental service was established in this country and subsequently the American Chemical Society offered to make the services available to the rest of Europe through the OECD Information Policy Group. These discussions have only been in progress for some six months, but already a number of European countries are planning to set up their own experimental information units for chemistry.

Co-ordination of national activities

Such national experiments may well arise from the enthusiasm of one person or organization. Thus a number of experiments may start in a very short time in a number of different countries. In each, the same or similar problems will be met and perhaps solved. Eventually other countries will wish to participate and in this situation there should be a role for one of the international scientific organizations. In scientific and technical information at the present time OECD is playing an active role. Two working parties, which also provide a forum for interchange of experience, are currently promoting the internationalization of both MEDLARS and some of the *Chemical Abstracts* services but the onus for action lies mainly with individual countries. Within these countries action normally requires money and this often involves government. It has become clear that action is greatly facilitated when there exists within a country one focus charged with the responsibility for the development of scientific and technical information. Such an organization must work in close contact with all parties involved in scientific information for maximum efficiency.

The benefits of international co-operation

The likely outcome of the various current activities will be international agreements whereby each country will provide input to the international systems in return for the use of the data base. Exact details of use have not yet been defined but whatever arrangements are made no one country or group of countries should be expected to subsidize permanently the use of the service by the rest of the world. In addition, some adaptation of the organizing and financing of existing information services may be necessary to ensure that a fair return is received for a fair contribution by a country. If such an international system can be made to work, I believe it has the following potential advantages:

(*i*) Input to the information service will be faster, particularly as computer printing of primary journals increases. Changes in primary publication methods might also increase this speed.

(*ii*) The duplicate preparation of abstracts will be diminished. At the present time the major journals may be covered by four or five abstracting services. If countries accept responsibility to provide input from their primary articles, then governments ultimately responsible for the supervision of this input will be able to ensure that one abstract is prepared in such a way that it can be edited for use in several information services.

(*iii*) The use of information services will increase within countries, since the basic data base can be exploited and repackaged to suit local needs and economic situations. Input and use will be both in the same country and both on the same tariff.

(*iv*) While countries will have access to the complete world's information, the use of the data base will be national and close contact can be developed between the providers of the service and the user. This is most important for its effective use.

An international system of this type will have considerable repercussions on the abstracting services themselves. Eventually, printed versions and magnetic tape versions will be very closely integrated, so that the use of both must be governed by the same international agreement. This will be a revolutionary change for many abstracting services, whose responsibilities will be very much wider than at present and it will be necessary to achieve a delicate balance between the special requirements of the different countries.

Experimental computer-based information services

Several services have been established experimentally throughout the world using magnetic tapes supplied by US information services and a number of other services are currently being developed. The tapes which have been used are those supplied by the National Library of Medicine (MEDLARS), the National Aeronautical and Space Administration and the Chemical Abstracts Service (Chemical Titles and Chemical Biological Activities). Similar problems have been faced in each case and these are summarized below. However, the lessons learnt from these early attempts can be used now to simplify the development of an experimental information service, with the result that these should become more widespread in the future.

The main problems which have been faced are:

1. *Hardware.* In many of the instances to date the first stage in the introduction of an experimental information service has been the reconstruction of programs to work on a local computer. Such reprogramming has been due to the wide differences in hardware available in different countries and to the fact that the different abstracting services have adopted different formats on the magnetic tapes. Thus it has been very rare that a suite of programs written for one experimental information service can be used with tapes produced by another information service. However, the situation in the future should be different, since hardware should be more compatible and there should be more international liaison so that the availability of suitable programs is known and formats adopted by the abstracting services may be standardized. On the occasions when computer programs written by the main abstracting service have been used another problem has arisen due to the different national attitudes to computer time. Thus programs which can be tolerated in countries with ample computer time are considered extremely inefficient where computer time is very scarce.

2. *Manpower.* At the beginning of a project to introduce an experimental information service into a country there are usually very few suitable staff with experience of both computers and information services. Both computer personnel and scientists have to be recruited and trained to operate the service, in some cases by secondment to the information service. Alternatively, preliminary training can be carried out by a satellite information centre in a neighbouring country. This approach has been tried in the extension of MEDLARS into Europe and a number of European medical librarians and research workers have received training at Stockholm or Boston Spa. Also arrangements were made to enable small numbers of searches to be processed for them in order that their training might be put to practical use in their own countries. In this way the French medical organization INSERM, the equivalent of our MRC, is making extensive use of our MEDLARS service on a repayment basis. This arrangement has the full approval of the US National Library of Medicine and a member of the INSERM staff has recently spent four months in Washington receiving more advanced training. Some use but on a smaller scale has been made by other countries of the *Chemical Abstracts* services provided by the Chemical Society Research Unit at Nottingham.

3. *Type of Indexing System.* The method of indexing, i.e. controlled language

or natural language, may affect the ease with which an information service can be extended internationally. The use of a controlled language requires that users of the service understand exactly the meanings put on the various terms by the indexers. This can require an extensive training period (four to six months) both for those developing the service and those who are to use the service. Experienced indexers consider that the consistency of indexing improves when they are located in one place and an appropriate revising system initiated. However, it is difficult to recruit suitable personnel for indexing in some countries and the international extension of the information service implies that indexing may be done in more than one place. To ensure compatibility, the information service often requires an extensive in-house training period for the various national indexers, which might involve problems of finance and secondment. Naturally, there is a wish on the part of the parent information service to minimize the number of additional locations but this is incompatible with a country's natural desire to be responsible for its own input. Furthermore, knowledge of the indexing practice is necessary when using the service and there is an advantage in locating indexers with search formulators using the system.

No such problems occur with natural language systems: synonym dictionaries can be provided and may require modification according to local usage. This can be done as experience is gained in the experimental phase of the information service. Greater difficulties occur when the material is not in the language of the country, but I do not think these would be any greater than with a controlled language. In that case suitable translations can usually be found for the indexing terms but the problem of translating the definition is still quite substantial.

4. *Finance.* The arrangements by which experimental information services have been developed have required only a small amount of finance from the country developing the service. Even so, government support has been requested and provided from the beginning in many cases. As the use and experience of the service increases so does the financial commitment, but all parties concerned have had time to consider the long-term financial implications during the development period. When several countries have developed experimental services simultaneously, it is conceivable that a multilateral agreement covering the long-term financing of the services might be arranged but there are a number of difficulties. One of these is that there is at present no suitable organization for the administration of multilateral financial agreements and it would take time to build one up. Thus, the first formal agreements for co-operation in international information will be on a bilateral basis but some uniformity in agreements may be achieved through the activities of organizations such as OECD. It is too early now to decide whether there should be established an international information agency responsible for all payments and transactions in kind, or whether a co-ordinated series of bilateral agreements will be more effective in taking into account the requirements of individual countries. Whatever arrangement is finally decided, it is already clear that governments will be involved in the financing of experimental work and perhaps in the more permanent agreements under which national input is

provided to information services. Equally, these agreements may require considerable alterations in the organization of the information services.

Specialized information services

In addition to the major disciplinary information services on which I have concentrated so far, there is considerable scope for the use of computers and international co-operation in more specialized information services. These services exist or will be developed for those areas of science and technology where there is a particularly high demand for information. The services may take the form of repackaged information from one or more disciplinary data bases, or of specially prepared abstracts, or by the critical selection of papers by scientists actively working in that area of science. Such specialized information services can ease the problem for scientists working in their field and a wide range of services exists already. Some of these are provided by very small staffs using simple inexpensive equipment, but others are already making use of computers.

Considerable opportunities exist for international co-operation in the development and use of specialized information services and centres; but although efforts are being made through CODATA, a Committee of the International Council of Scientific Unions, to organize an international network of centres specializing in critical data analysis and compilation, there is no similar move for those specializing in the analysis of published information. However, some specialized information centres and services are already operating on an international basis and one example is the Biodeterioration Information Centre at the University at Aston. Input is provided by over one hundred scientists and technologists in thirty countries who scan journals for their own purposes and send to the centre at frequent intervals details of biodeterioration references by means of duplicate reference cards. A list of these references is published quarterly and distributed to over four hundred users in sixty countries. The references are also indexed and a question-answering service provided with the aid of a set of optical coincidence cards. Although used mainly by UK scientists with telephone inquiries, a number of written requests from overseas have been dealt with and inquirers put into contact with experts.

While many specialized information centres are supported by Government, a number operate on a commercial basis. These are developing increasing international links which aid the export of technology as well as providing additional income from their overseas sales. One such service, Indata*, which provides 'product' information on instruments, electronic components and automation equipment, is investigating the feasibility with Czechoslovakian organizations of providing a special service which would incorporate information on new Czech instruments into a data base. A controlled indexing language is used and a procedure is under study devised for translating specification terms by computer from English to Czech and vice versa.

Although it is usual for an information service to be developed within one country and then extended to others, the International Food Information

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* Since this paper was given, Indata has suspended its operations.

Service, currently under development, provides an interesting exception to the usual pattern of events. This service is being developed on an international basis from the start by the Commonwealth Agricultural Bureaux in this country, the Institute for Documentation in Germany and the Institute of Food Technologists in the United States. The project started at the beginning of this year and the preparation of abstracts has been arranged on a world-wide basis. A modern indexing system is being developed and it is intended to print the journal by computer typesetting methods. Eventually a full range of information services will become available. It was the original intention to produce the first issue of the *Abstract Journal* in January 1969 by making use of existing software, but some difficulties have occurred which may delay this date by a month or two. Even so, it will be a remarkable performance to develop completely an abstract publication using computer methods in less than eighteen months.

The use of information services

It is likely that there will soon be a processing group (experimental or permanent) in this country for many of the computer-based information services in the physical and biological sciences. Each will have its own range of services—SDI, current awareness, specialized publications and eventually searches of files of information covering several years. By previous standards use of these services may appear expensive and considerable educational work at present in progress will be needed to ensure that effective use is made of them. In addition, some understanding of the importance and monetary value of scientific information will be necessary to justify the cost of their use. It may be difficult to choose from the range of services available the one to use for a particular information requirement, and for a considerable time there will be a need for effective information scientists capable of understanding both the user's requirements and the capabilities of the various information services. This work will be helped considerably if the average research scientist is aware of the general principles of information services and their limitations and, in addition, if some central agency exists with the responsibility of evaluating the use of existing information services and making details of the experience gained in their use available to new users. Such an agency would do much to prevent the same mistakes being made and to improve the use of information services. It would also be in a unique position to assess the need for new information services to fill in gaps in the existing network.

DISCUSSION

Mr T.M. Aitchison (Institution of Electrical Engineers) said that Dr Somerfield had mentioned international services emanating from the USA and used in this country. It might be interesting to consider a service where these roles are reversed. The publications of INSPEC, the Information Service in Physics, Electrotechnology and Control, of the Institution of Electrical Engineers, had a truly international range of input and of subscribers. They consist of the three parts of *Science Abstracts* and the associated *Current Papers* and would be produced by a computer-based photo-typesetting system from January 1969.

Parallel with this change in production methods there had, he said, been a re-examination of the question of co-operation in providing input. They had been encouraged by the increasing interest shown by different primary and secondary publishers in providing indexed and abstracted material for *Science Abstracts*. Co-operative agreements were in hand with organizations in the USA, Canada, Germany, France, Russia and Poland.

Mr J.E.L. Farradane (City University) said that while having no disagreement concerning the value of international co-operation or mechanization, there were underlying dangers of inadequate communication. The user was a lazy animal, and incoherent in stating his needs. There was increasing comment that the large abstracting journals were unreadable. Abstracting journals with specialized points of view might help to get information across for general use. Abstracting needed to be much better done. There was at present considerable doubt about the effectiveness (not more than 50 per cent recall) of mechanized systems, which might become too easily accepted as sufficient (again by the laziness of the user). There was a danger that more information than ever would be lost by these methods of getting information to the user. There was still a need for personal contact with the user, and interpretation in specialized ways of available knowledge. This is the job of the information scientist.

Sir Thomas Scrivenor (Commonwealth Agricultural Bureaux) said that it did not follow, as Mr Farradane feared, that an international information service was necessarily too large to be useful. The CAB had been providing an information service for forty years, which was international in the sense that it was supported by twenty-five independent governments and in the sense that its services were used all over the world. It had recently launched a new service of Food Information in collaboration with the American Institute of Food Technologists and the Institut für Dokumentationswesen and its associated Zentralstelle für maschinelle Dokumentation. The *Guide to the World's Abstracting and Indexing Services in Science and Technology* listed 1,855 separate services, mainly national. This was far too many, and any steps to reduce the number were to be encouraged.

Mr Simon Francis (North-Western Polytechnic) asked whether Dr Somerfield thought that Information Exchange Groups had a future? In effect, was the United States-financed experiment to be the only one of its kind?

Dr Somerfield said that there were advantages for a worker at the bench when he depended on this type of Invisible College. The emergence of the IEG system was symptomatic of the need to cut down the long delays in communication. The IEG system, if restricted to people in the field, had a useful role to play, but only if it was given informally.

Mr M.B. Line (Bath University of Technology) said that the first major experiment of Information Exchange Groups came to an end for reasons which were not fully clear, but were certainly connected with the difficulties of publishing articles in journals, when the articles had already been circulated. They now looked like starting again in a more limited form, with summaries or idea papers circulated (rather than draft articles) to biochemists on an international scale. There was presumably a strongly felt need for them.

Mr J.S. Rippon (Metal Box) said that international services were not incompatible with specialization. More specialized centres were needed as subjects became fragmented. For the most effective centralization one needed highly qualified information scientists in the local units who could effectively exploit the products of the centralized services. These should be repackaged to suit the needs of the individual user.

Mr H.A. Stolk (International Aerospace Laboratory, Amsterdam) drew attention to the European Space Documentation Service (operated by ESRO, ELDO and Eurospace) which had been available for the past year and a half by agreement with NASA. This service had the complete (non-classified) file of NASA at its disposal on magnetic tapes and on microfiche. This enabled the European Service to do retrospective searching and provide SDI.

Mrs G. E. Taylor (Zinc and Lead Development Associations) said she would like to support Mr Farradane's statement about large and unwieldy abstracting journals. In the metallurgical field a number of journals were merging. Consequently it was becoming a most time-consuming job to scan such journals as *Metals Abstracts,* which was a joint production of ASM and the Institute of Metals. She felt that there was most certainly a need for the smaller specialized journals such as *Zinc and Lead Abstracts* as a separate entity.

Also with regard to extending information on an international scale *Zinc and Lead Abstracts* was a truly international project. With a circulation of over seventeen thousand it covered all Commonwealth countries, Japan, Scandinavia, South Africa, Israel, USA, Zambia, etc.

Mme Coulomb (CEA) said the Commissariat à l'Energie Atomique was very ready to cooperate internationally. Since June 1968 it had been producing an index to the French literature in the nuclear field, based on computer input intended for the INIS project at the International Atomic Energy Agency in Vienna. This *Index de la littérature nucléaire francaise* was a list of references including abstracts and containing a number of indexes (authors, affiliations, sources, etc.) both in French and English.

INTERNATIONAL DOCUMENTATION STANDARDS

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Paper presented at the 42nd Aslib Annual Conference, Canterbury, 22nd–25th September 1968

The Concept of a Standard

THE American *Magazine of Standards* regularly uses as its banner headline the anonymous quotation 'Standardization is dynamic, not static; it means not to stand still, but to move forward together'. It is spaced out with each word of the estimable text separated for double emphasis, and it always evokes in me an uncomfortable picture of a small pious nod of concurrence from the reader before he eases back into a more comfortable position in his pew for a worthy sermon. The word 'standardization' does often have a numbing effect and a pejorative sound. Standards do seem dull, and it is important to break through this psychological barrier.

In part the difficulty stems from the history of engineering standards—the fear of the lowest common denominator, the distaste for a just adequate minimum, the suspicion of a frustrating barrier which might inhibit new designs or reduce commercial advantage. Standards are agreed to be a good thing—for the other chap. Work on standards is seen as an activity which should be given languid support from the touch line, rather than as a scrum in which one must shove and sweat and get scratched and muddy and rub up hard against each other if one is to make any progress at all. In part it is because too often standards have been restrictive detailed specifications of the dimensions and materials for a product. In part it is because standards have often looked dull and old-fashioned in their published form, have been written in a pseudo-legal jargon, have taken too long to prepare and have not been up-dated quickly enough.

The picture is changing as industry—especially exporting industry—and governments throughout the world realize that they need standards, and in the last ten years massive support has begun to swing behind not only factory and group and industry and country standards, but also behind international standardization, which has ceased to be just a paper political exercise. Moreover, in seeking agreement on a standard it is now more usual first to consider the functional requirements and then to specify the criteria necessary to ensure that this function is satisfactorily fulfilled, in terms of a performance standard which may say nothing at all about dimensions or design or materials, but will concentrate on fitness-for-purpose. Standards are seen as agreements which will allow communication without ambiguity, will ensure quality and assess reliability, will provide frameworks within which all may work with compatibility, and will provide common codes of practice as guidelines.

The background to documentation standards

Although not usually conceived in such high-faluting terms, documentation standards are the prerequisite of communication of any kind, and international documentation standards have been around for a long time and are applied by all of us all the time. Alphabets themselves, the direction of writing, the symbol used for the decimal marker, the expression of numbers, the form of an address are all early examples; they are also all examples of areas where there are still conflicting standards which militate against quick and complete understanding. More recent and more explicit instances of international documentation standards—those agreements that are of central concern to the librarian, editor, publisher, information worker and documentalist—might be cataloguing codes, common orders for alphabetical arrangement, the latin letter used to express the Russian B, the 'international library card' and the size of microfiches; again for each of these there is a broad stream of agreement in many countries but sufficient divergence in detailed practice to cause much confusion. The pattern is incomplete and haphazard; most documentalists recognize that effective communications are a first essential, and these are impossible without agreed and implemented standardization. The progress of international standards in this sector, however, is frustrated by two other factors; firstly, there is no clearly identifiable single wealthy industry with a profit interest in standards being attained, so finance is very often a problem; secondly—dare I suggest—many librarians and bibliographers tend to be perfectionists and will sometimes resist publication of the imperfect even where they agree that it would be better than nothing and could be revised and improved later; the end of the rainbow often appears a tempting goal.

Now, however, there is a surge of activity on both the national and the international fronts. There is a growing recognition that at least the communicators should try to communicate effectively, and that the mechanization of library processes requires not only standardization of the automated technique and equipment but—even more important—standardization of the present manual processes and conventions if the mechanization is to be carried out efficiently and economically and compatibly. Moreover, librarians have come to accept that it is not sufficient to agree and to publish a standard but one must then preach it from the house tops and urge its application by every means possible. Coupled with this is a recognition that in documentation as in every field standardization and research must go hand in hand; effective research requires good standards, successful standardization must be founded on the right research; standards cannot be too far ahead of practice but yet must lead a little; they should help, not rule; the infill should never be more detailed than is necessary.

Centres of activity and responsibility

The number of different international organizations which are interested and involved in the preparation of international standards for documentation is now formidable and it is growing fast. This is not a situation which is unique to documentation and as in other areas it would be wrong to suggest that there is not a place for each of the organizations concerned; they are often of a different character or at a different level—governmental, or national non-governmental, or professional, or orientated towards a particular subject or specialized discipline; they harness different enthusiasms, serve different purposes, tap different resources. Nevertheless the alphabet soup of their acronyms, abbreviations and initialisms adds up to a bouillabaisse with at least thirty different ingredients, and this is a hindrance as well as a help.

The 'Big Five' are of course the International Federation for Documentation (FID), the International Council of Scientific Unions—and especially its Abstracting Board (ICSU/AB), the International Federation of Library Associations (IFLA), the United Nations Educational, Scientific and Cultural Organization (Unesco)—especially its Department of Documentation, Libraries and Archives, and the International Organization for Standardization (ISO)—especially its technical committee (46) for documentation, the committees for paper, terminology, photography, data processing, office machines and (in process of formation) printing technology. At the national level these are joined with, respectively and especially, Aslib, the Royal Society, Library Association, DES and BSI Documentation Standards Committee OC/20.

Linked with these central bodies are large organizations with a special subject focus who nevertheless have a wide interest in information standards, such as International Atomic Energy Authority; broad bodies with a particular interest, such as ICAO and pictograms, or NATO and commodity codes; regional organizations such as European Standards Co-ordinating Committee (CEN) for the thirteen Western European countries or Comecon for the CEMA Warsaw Pact countries; and all manner of smaller centres with a special interest, such as the International Cartographic Society or the International Council for Reprography. These are supplemented by a network of tripartite and bilateral agreements between individual countries, such as UK/USA, UK/Poland, UK/USSR, UK/France/Germany.

Some of the documentation standards work being done in ISO

The work in progress within ISO/TC 46 (Secretariat—Germany) is currently of four main kinds—bibliographical standards, conversion of written languages, microform standards, and terminology.

In the first group come standards for the index of publications, title leaves, abstracts and synopses, bibliographical references, the presentation of translations, an international system of standard book numbering, library statistics, the presentation of library directories, the writing of dates, alphabetical arrangement and the abbreviation of titles of periodicals. Very often the international draft proposal being considered is based on an existing national standard. Certainly we in the United Kingdom are now firmly committed to the policy of reflecting published ISO recommendations immediately with compatible national standards and of putting forward appropriate national standards as draft international proposals; examples in this group will be the British Standards for serials, for conference proceedings, theses, published music, research reports and loose-leaf publications. The work on library statistics is being carried out jointly with IFLA and Unesco and the project on the presentation of library directories is also linked with this. The first meeting of the ISO working group for international standard book numbering is to take place in London tomorrow (26th September); Mr Wells has explained the importance of such a system for shared international cataloguing; clearly it is vital that there should be international agreement as to the letter or number prefixes or suffixes used to indicate the country of origin; provided this can be settled then neither Standard Book Numbering Agency nor Professor Foster (who designed the scheme) feel they need to be very alarmed if the actual number system used within other countries is not identical with the nine digit publisher prefix/item number/check number system adopted for the UK and the USA.

International agreement as to the concepts used by librarians and documentalists and the terms which should and which may and which should not be used to describe these concepts is absolutely fundamental. Here again Unesco and IFLA are also involved with ISO/TC 46, as is ISO/TC 37. Poland has done some serious drafting work for FID, the USSR has published a Comecon glossary and, very fortunately, Dr Coblans is himself Chairman of the BSI Committee which is preparing a parallel British Standard glossary.

The projects for the conversion of written languages include the transliteration of Arabic, Cyrillic, Greek and Hebrew characters, the conversion of Yiddish, the romanization of Chinese and Japanese and the conversion of non-Slavic Cyrillic letter languages. The first three of these reflect British Standards which are now published. In relation to Chinese and Japanese the UK is now in the van; the strong pressure for standard forms of the Pinyin and Wade-Giles systems for the romanization of the former to be set down has come not only from librarians and orientalists at universities, but also from the intelligence authorities, exporters and the BBC.

Some of the activity on standards for microforms is listed at the end of this paper; it has been carried out in liaison with ISO/TC 42. The United Kingdom is a very central participant and especially influential because the work of the BSI Committee is strongly backed by the National Reprographic Centre for documentation. The project for an international standard for micromire is an example of the dangers of theoretical standardization; with good intentions France proposed a draft specification which seemed sound and which no other country was in a position to argue against. However, later research and practical work at Hatfield showed some serious flaws, and the ways in which they could be overcome.

Another danger is illustrated by the recommendation for the abbreviation of titles of periodicals; the ISO draft followed BS 4148 but was not compatible with the US standard. Our BSI Committee, under the Chairmanship of Mr Porter, of National Central Library, decided that it would be right to go much more than half way towards the Americans in eliminating this divergency. By close and friendly relations, including a visit by the UK Chairman to the USA, great progress has now been reached on a joint UK/USA draft and we have also managed to persuade ISO to hold up publication of the revised international recommendation in order that it may reflect this agreement. There were those who argued that it would have been better to publish the international revision and then to amend it later; whilst this is often the right course in standardization if one is to achieve anything at all this did seem an instance where more harm than good would be done by a misleading early publication. The incidence of discrepancies between national and international standards for documentation should be much fewer in the future, although we still have to eliminate some small divergencies between the corresponding standards for the transliteration of Russian Cyrillic characters into Latin characters.

Examples of work being done elsewhere

This spate of ISO/TC 46 activity is echoed in other ISO committees and in all the other forums. Three of the most important activities are the ICSU/Unesco Joint Project on the Communication of Scientific Information, which is especially linked with the proposals of Dr Sherwin for a world information system—the specific activity on formats for data exchange, which is a subject being considered in almost every single forum—and the considerable work on the crystallization and revision of UDC being carried out at FID under its Central Classification Committee.

Co-ordination and dangers

This survey of part of the field indicates the scale and complexity of the international documentation standards activity that is in hand, and this is often multiplied at a similar series of levels within individual countries in national standards activity.

Much effort has been put into co-ordination, sometimes by joint projects tackled by two or more bodies together, sometimes by liaison committees and all too often by exchange of drafts and proposals and revised drafts and revised proposals and final drafts and brief minutes and unconfirmed minutes and definitive minutes. There are ISO/IFLA, Unesco/ICSU, FID/CIB, FID/ISO, Unesco/ISO projects and many more complex alliances.

This is not to be sneered at and it is nothing to be cynical about; international standards for documentation must carry most countries with them and most of the liaison bodies with them if they are to be of real value. Nevertheless I think there are signs of growing dangers in the present position. In countries where the number of appropriate experts is few, each man wears a large number of hats and represents his country in many forums; he tends to become a professional international committee man and to lose touch with the real work for which standards are needed, and sometimes even to lose touch with his own country. Where the experts are many, either there is generated an even more massive need for exchange and liaison and co-ordination within the country concerned, or the governmental or professional or disciplinary body sponsoring each individual tends to acquire, without meaning to, a vested interest in concentration on his particular forum and project; so attempts at international standardization result in national non-standardization. Another problem is that all this international work is backed up by procedures, rules and regulations which are often long-winded and long drawn-out in their desire to be democratic, so short cuts are accepted or are taken and confusion increases; the revision of UDC is a striking example of this danger. Up-dating of any kind becomes difficult and it is hard to keep in step. Resources are dispersed;

energies are dissipated. The friendly co-operation between international bodies and national bodies and individuals has mitigated these dangers up to now to a surprising degree. If I instance in the United Kingdom Mr Wilson, Mr Collison, Mr Richnell, Dr Coblans, Mr Mallaber and Mr Alan White it is not to single them out but to name them as examples of those who are involved in both national and international documentation standards in many places and who prevent confusion and waste. But the position is rapidly becoming too complex for the picture to be kept clear by a few men of goodwill.

Not the least of the dangers, I believe, is that because of the complexity of the position even for those involved in it, the picture must seem almost hopelessly confused for many would-be consumers of standards who are not, and may lead them to give up. I was recently in what is said to be the third largest library in the world—perhaps I should identify it only by the fact that it is not in a capital city, and found that there was only the thinnest theoretical interest in extramural standardization. The library had its own cataloguing code, its own list of abbreviations, its own rules for transliteration, its own specification for binding and its own glossary of definitions; it saw little need for sharing these with others or for attempting to apply standards agreed for a wider circulation; some astonishment showed through but I soon found myself on the defensive as it was pointed out that the same position existed in many of the great libraries in this country. Not only does communication of information by computers and the mechanization of library operations make this isolationist position ridiculous now but it is increasingly being accepted that the large libraries and information centres in any country have a duty by precept and example to encourage and help the use of standards in the smaller libraries and information services of their own country and also in other small and newly developing countries.

Another problem is that those who have in any way financially supported standards work tend to wish to publish the results and so—and this mainly lies ahead—international documentation series will be published in a proliferation of series and formats; in some their relation to the whole context will not be clear, in others the authority will not be evident; standards will overlap and will be separated by uncharted gaps; presentation and distribution and availability will vary greatly.

Need for the future

It would be a great pity if these dangers were to hazard the mass of valuable international documentation standards work now being undertaken. As a personal view I would like to suggest that the cure lies not in further general cross-co-ordination, but in specific action in four directions:

1 streamlining procedures for the preparation of standards;
2 preparation of regular collated progress reports on the work as a whole;
3 unified planning of all new work;
4 publication of all international documentation standards in a single series.

The streamlining of procedures and the shortening of preparation time should be possible both because most of the organizations concerned are now strongly enough established to be able to slough off some of the safeguards that were necessary at their original constitution and because it is now increasingly recognized that as standards can be easily revised one should aim at quick publication rather than perfection. It is important that the speeding-up procedures be adopted officially and above board so that it can be seen that there is no longer danger of the power of decision devolving upon a small coterie or being relegated to the secretariat. Given these precautions there should not be too much resistance. We have found at ISO that real improvement can be achieved quickly by limiting committees to active members and by combining consecutive stages of approval of drafts. Dr Fomin at VINITI in Moscow plans soon to submit radical proposals for the rationalization of UDC procedures. If such steps are not taken in each forum either the rules will be disregarded or one country will go it alone, despite the cautionary example of SfB.

Regular overall progress reports and unified planning of all new work are now vital if wasteful overlap is to be avoided, and surely there is now enough goodwill, strength and multiple representation for no sectional jealousies to stand in the way of these moves. To find the resources of staff and money to do the job well will not be easy, but perhaps there is a gleam of hope here in the new ISO Working Group on Standards Information which is to hold its first meeting in Moscow in November; the USSR are to provide the secretariat and clearly the State Committee for Standards intends to back the work, which includes the whole of the documentation standards field, strongly, where one realizes—and I have counted heads—that the documentalist staff now engaged full time in the Soviet Union on standards information work is well over one thousand it will be seen that if this international co-ordination work should be accepted there would be the resources to see it through. From the United Kingdom each of the existing organizations would be able to provide supplementary information; one forum which would be especially pertinent is the new BSI Research and Development Panel for Documentation Standards, OC/20/—/5. I am very glad to be able to tell you that Mr Richnell has agreed to be the Chairman; his committee will have two tasks—firstly to ensure that all research work in hand is fed into the appropriate standards drafting committee, and secondly to identify research work that is not being carried out but is necessary if we are to have the right standards and to encourage its institution at the most appropriate university or centre such as Aslib Research Department. New work we might propose for international activity might include standards for the physical make-up and performance of documents—such as paper life, strength, openability and legibility; any such work would build on the US Library Technology Project and on the research now being undertaken here by the Working Party on Relations Between the Librarian and the Book Trade. Another matter which many press as urgent is agreement on a special computer language for information applications; the work being done at the University of Newcastle upon Tyne would be pertinent here. Again there has been little organized consideration of standards for the furniture and equipment used in libraries in relation to their function; experience in other areas suggests that such standards could achieve substantial economy and greater fitness for purpose without entailing any lowering of aesthetic standards; they would be based on ergonomic and anthropometric considerations and might be specially valuable for newly developing countries. Commodity codes and the sizes of books and documents could be other projects.

It will be difficult reaching agreement on the publication of all international documentation standards in a single uniform well-presented series, but I think this is the most vital need of all for the potential user and so for the implementation of the standards. Standards which are hidden and standards which are not applied are worse than no standards at all. Any such plan would necessarily involve the surrender of some surface sovereignty by individual organizations and the acceptance of some inconsistencies, but the benefits would be great. I believe that any influence that Aslib or its members could exert in this direction would be exceedingly worthwhile.

1. SOME OF THE INTERNATIONAL ORGANIZATIONS CONCERNED WITH DOCUMENTATION STANDARDS

ISO : FID : ICSU : IFLA : UNESCO : IPA

IEC : CEN : CENEL : CENTRI : CODATA : COMECON : OECD

ALJHE : BIRPI : CIB : EBU : ETC : FAO : FIEJ : FIPTP : IAEA : IATUL : ICA : ICSSD : ICAO : ICC : ICIREPAT : ICOGRADA : IIR : IMCO : OIML : UIEO : WDC : WHO : WMO.

2. THE MAIN ISO COMMITTEES CONCERNED WITH DOCUMENTATION STANDARDS

ISO/TC46	Documentation
ISO/TC6	Paper, board and pulps
ISO/TC37	Terminology (principles and co-ordination)
ISO/TC42	Photography
ISO/TC97	Computers and information processing
ISO/DATCO	Writing of dates

3. ISO RECOMMENDATIONS OF CENTRAL INTEREST TO DOCUMENTALISTS

R4–1953	International code for the abbreviation of titles of periodicals
R8–1954	Layout of periodicals
R9–1954	International system for the transliteration of Cyrillic characters
R18–1955	Short contents list of periodicals or other documents
R30–1956	Bibliographical strip
R66–1958	Paper vocabulary
R77–1958	Bibliographical references. Essential elements
R169–1960	Sizes of photocopies (on paper) readable without optical devices
R193–1961	Microcopies on transparent bases. Sizes of recommended bases
R214–1961	Abstracts and synopses
R217–1961	Method of expression of dimensions and direction of manufacture of unprocessed writing and printing paper
R218–1961	Microcopies. Scale of 35 mm microfilms for international exchange

R233–1961	International system for the transliteration of Arabic characters
R259–1962	Transliteration of Hebrew
R260–1962	Terms relating to microcopies and their bases
R353–1963	Method of expression of dimensions of processed writing paper and certain classes of printed matter
R371–1964	Terms relating to microcopy apparatus
R435–1965	ISO conventional typographical character for legibility tests (ISO character)
R446–1965	Microcopies. Legibility tests. Description of the ISO mire (ISO test object) and its use in photographic document reproduction
R452–1965	Essential characteristics of 35 mm microfilm reading apparatus
R478–1966	Paper. Untrimmed stock sizes for the ISO–A series. ISO primary range
R593–1967	Paper. Untrimmed stock sizes for the ISO–A series (Supplementary series)
R618–1967	Paper. Overall trimmed sizes of articles of stationery that include detachable sheets
R646–1967	6 and 7 bit coded character sets for information processing interchange
R686–1968	35 mm Filmstrips. Dimensions and formats
R689–1968	Microcopies. Legibility tests. Description and use of the ISO micromire (ISO micro test object) for checking a reading apparatus
R690–1968	Bibliographical references. Essential and supplementary elements

4. DRAFT ISO RECOMMENDATIONS

DR 315(3)	Transliteration of Greek into Latin characters
DR 676	Naming principles
DR 781	Vocabulary of terminology
DR 792	Guide for the preparation of classified vocabularies (Example of method)
DR 996	Alphanumeric character sets for optical recognition
DR 1056	Microcopy. Measurement of the screen luminance of microfilm readers
DR 1189	International unification of concepts and terms
DR 1243	Revision of the ISO Recommendation R9–1955—International system for the transliteration of Cyrillic characters
DR 1278	Revision of ISO Recommendation R4–1953—International code for the abbreviation of titles of periodicals
DR 1281	Abbreviations of typical words in bibliographical references
DR 1294	Abbreviations of generic names in titles of periodicals
DR 1299	Flowchart symbols for information processing

DR 1314	Code for numerical control of machines (compatible with the ISO 7-bit character set)
DR 1320	Implementation of the 6- and 7-bit coded character sets on 7 track ½ inch (12.7 mm) magnetic tape
DR 1321	Implementation of the 7-bit coded character set on 9 track ½ inch (12.7 mm) magnetic tape
DR 1322	Guide for the definition of 4-bit character sets derived from the ISO 7-bit coded character set for information processing interchange
DR 1323	Magnetic tape labelling and file structure for information interchange
DR 1416	Index of a publication
DR 1418	Representation of 6- and 7-bit coded character sets on punched tape
DR 1451	Function key symbols on typewriters
DR 1452	Printing and function keys on typewriters

5. A SELECTION OF THE UNITED KINGDOM ORGANIZATIONS REPRESENTED ON THE BSI COMMITTEES CONCERNED WITH INTERNATIONAL STANDARDS FOR DOCUMENTATION

Antiquarian Booksellers Association
Aslib
Association of British Library Schools
Association of Teachers in Technical Institutions
Association of University Teachers
Bibliographical Society
Biological Council
Bodleian Library
Booksellers Association
British Association of Industrial Editors
British Archives Council
British Computer Society
British Copyright Council
British Council
British Federation of Master Printers
British Institute of Management
British Museum
British National Film Catalogue
British National Bibliography
British Record Society
British Records Association
Business Equipment Trade Association
Cement and Concrete Association
Classification Research Group
Classification Society
Committee of Directors of Research Associations
Committee of Vice-Chancellors

Commonwealth Agricultural Bureaux
Council of Engineering Institutions
Cranfield
Defence Codification Authority
Documentation Processing Centre
Electricity Council
Engineering Equipment Users' Association
Government Communications Headquarters
Guildhall Library
H.M.S.O.
Incorporated Society of Authors
I.N.S.P.E.C.
Institute of Information Scientists
Institute of Journalists
Institute of Reprographic Technology
Institute of Technical Publicity and Publications
Institute of Linguists
Institution of Electrical Engineers
Library Association
London College of Printing
Management Committee for Standards Associates
Microfilm Association
Ministry of Agriculture
Ministry of Defence
Ministry of Housing and Local Government
Ministry of Technology
Museums Association
Music Publishers' Association
National Book League
National Coal Board
National Central Library
National Computing Centre
National Council for Academic Awards
National Lending Library for Science and Technology
National Library of Scotland
National Library of Wales
National Physical Laboratory
National Reference Library for Science and Invention
National Reprographic Centre for documentation
Newspaper Publishers' Association
OSTI
Patent Office
Periodical Publishers' Association
PIRA
Permanent Committee of Geographical Names
Presentation of Technical Information Group
Private Libraries Association

Public Record Office
Publishers Association
Royal Institute of British Architects
Royal Society
SfB Agency
Science Museum Library
SCONUL
Science Abstracts
Scottish Record Office
Sheffield Post-graduate School of Librarianship
Society of Archivists
Society of Indexers
Society of Technical Publication Contractors
Standard Book Numbering Agency
Standing Committee for Preservation of Historical Manuscripts
Technical Publications Association
UKAEA
University College School of Librarianship
University Library, Cambridge
University of Newcastle upon Tyne
Working Party on Relations between the Librarian and the Book Trade

INTERNATIONAL PROJECTS SPONSORED BY FID

F. A. SVIRIDOV

Secretary General, International Federation for Documentation

Paper presented at the 42nd Annual Conference, Canterbury, 22nd–25th September 1968

TREMENDOUS scientific and technological progress is one of the major factors in the development of modern society. The increasing number of specialists engaged in research and development and constantly growing appropriations for this field of activity have resulted, among other things, in a vast volume of information produced. Both this and also the ever-increasing demands of the scientific and technical community for quick access to relevant information make international co-operation in scientific and technical information and documentation vitally important.

The International Federation for Documentation (FID), the oldest and the biggest international non-governmental organization in this field, is fully aware of the present demands and future trends in the vast area called information and documentation work. During the seventy-three years of its history the FID has been adopting and advocating new ideas in documentation and has been trying to procure effective international co-operation to ensure the implementation of the best methods in documentation. The FID's programme has been changing accordingly and at present the main tasks of the Federation include the following:

co-ordination of the documentation activities of international and national organizations, as well as of individuals;
elaboration and studies of basic problems of scientific and technical information;
promotion of the training of documentalists;
co-ordination of the revision and expansion of the Universal Decimal Classification (UDC);
international standardization of classification terms;
studies and evaluation of forms of communication used in providing technical information to industry;
studies in the areas of theoretical and operational aspects of machine techniques and systems;
survey and evaluation of linguistic and related studies with real or potential applications to information processing;
assistance to developing countries in creation of their national information and documentation services, etc.

This indicates that our Federation is no longer only a UDC-promoting organization and that the UDC work is only one of the areas covered by FID activities.

The FID is carrying out these and other tasks in close and effective co-operation with about fifty other international organizations active in the field of scientific and technical information and documentation.

I would like to mention here our co-operation with Unesco, where the FID has consultative status 'A'. We have close working contacts with the Department of Documentation, Libraries and Archives and the Department of Application of Science. Our co-operation with Unesco is carried out through specific projects, undertaken by the FID under Unesco contracts, and also by mutual attendance at the relevant meetings. Our Federation is participating in the activities of the International Advisory Committee on Documentation, Libraries and Archives, as well as in the work of the ICSU-UNESCO Central Committee to study the feasibility of a world science information system.

We have consultative relations also with the UN Economic and Social Council (ECOSOC), UN Food and Agricultural Organization (FAO), International Atomic Energy Agency (IAEA), World Meteorological Organization (WMO), Council of Europe, International Organization for Standardization (ISO), International Council for Building Research, Studies and Documentation (CIB) and International Telecommunication Union (ITU).

Another form of FID's co-operation with other international organizations is membership in those organizations. Thus, our Federation is a member of the International Federation of Library Associations (IFLA), International Council for Reprography (ICR), Committee for International Co-operation in Information Retrieval among Examining Patent Offices (ICIREPAT), International Committee for Social Sciences Documentation (ICSSD), International Council of Museums (ICIM) and Union of International Associations (UIA).

The FID's Statutes allow associate membership to other international organizations active in the field of information and documentation. The Commonwealth Agricultural Bureaux (CAB) and Commission of European Communities are at present Associate Members of the FID.

Still another form of FID's international contacts is represented by joint committees of the FID and other international organizations (CIB and International Association of Agricultural Librarians and Documentalists—IAALD).

The FID has close working relations with a number of international organizations although there are no formal connections between them. Here I would like to mention Asian Productivity Organization, Comecon, OECD, UNIDO, CODATA, ICSU Abstracting Board, IFIP, International Council on Archives, etc.

Participation in international meetings is one of the most effective ways of international co-operation. This form of activities has been actively pursued and the FID has been represented at almost all relevant international meetings all over the world.

Finally, the picture of the international contacts of our Federation would not be complete without a word about our Members and Affiliates. The FID has forty-six National Members and more than two hundred Affiliates. Among the National Members I would like to mention Aslib, Netherlands Institute of Information, Documentation and Filing (NIDER), the National Academy of Sciences of the USA, the National Research Council of Canada, the Science Council of Japan, the All-Union Institute of Scientific and Technical Information of the USSR Academy of Sciences, and many others.

Among the Affiliates there are such organizations as the Centro Nacional de

Documentación e Información Educativa in Buenos Aires, Centre International de Documentation Economique et Sociale Africaine (CIDESA) in Brussels, the National Library in Bulgaria, the Danish Library School in Copenhagen, Association française des documentalistes et des bibliothécaires spécialisés, Deutsche Gesellschaft für Dokumentation, Indian Association of Special Libraries and Information Centres (IASLIC), National Library of Ireland, Israel Atomic Energy Commission, Italian National Committee on Nuclear Energy, and many others.

It gives me great pleasure to say that the British Affiliates are playing an active role in the activities of our Federation. I would like to mention these Affiliates. They are as follows: Central Technical Information Unit of the Imperial Chemical Industries Ltd, Mr J. M. A. Cavanagh, Mr A. E. Cawkell, Dr P. S. Davison, Miss Ph. I. Edwards, Mr S. P. Foundos, Mr A. P. Harvey, Mr C. Horneman, Miss Ella V. Marshall, Mr H. J. Norris and Mr T. Todd.

After this general outline of a vast range of international contacts of the FID, I shall try to describe various international projects undertaken or planned by our Federation. Most of these projects are carried out by the FID Study and Special Committees. It might therefore be appropriate to give a brief summary of major projects carried out by our committees in 1968 only. I would like to note that the order in which the projects or committees are mentioned is not intended to be a reflection of the relative importance.

Research on the theoretical basis of information

The Study Committee on Research on the Theoretical Basis of Information (FID/RI) is chaired by Professor A. I. Mikhailov, Director of the Institute Naucnoj Informacii Akademii Nauk SSR (VINITI) and has its secretariat at the same institute (Baltijskja ul. 14, Moscow A-219).

The Committee members represent Belgium, Czechoslovakia, Euratom, France, Germany, Hungary, Italy, Japan, Netherlands, Norway, Poland, Rumania, United Kingdom, USA and USSR.

Among the major projects of the Committee for 1968 are:

preparation of an international thesaurus on scientific information;
preparation of a manual for users of information;
preparation and publication in 1968 of a collection of original articles on the theory of scientific information (text in English and Russian).

Classification research

The Study Committee on Classification Research (FID/CR), with its secretariat at the Dansk Central for Dokumentation (10 Øster-Voldgade, Copenhagen), is chaired by Mr R. Mølgaard Hansen, Director of the Centre.

The Committee has members from Austria, Belgium, Czechoslovakia, Denmark, Ethiopia, France, Germany, India, Israel, Japan, Netherlands, Poland, Sweden, United Kingdom and USA.

The Committee maintains close working contacts with classification research groups in Czechoslovakia, Denmark, France, Germany, India, Netherlands, Poland, Sweden, United Kingdom and USA.

The Committee's projects include:

standardization of classification terms; a draft list of fifty terms is being further developed. The project is carried out in close co-operation with ISO/TC 46;

co-operation with the Groupe d'Etude sur l'Information Scientifique in France, in preparing a multilingual thesaurus for information science, to serve as a basis for a mechanized concordance among a growing number of individual indexing schemes;

collaboration with the Bibliographic Systems Centre in Cleveland, USA, for operating an international collection of classification systems and thesauri;

publication of critical reviews in the FID/CR Report Series; No. 7 *Examination of the validity of the conclusions arrived at in the Aslib Cranfield Research Project,* and No. 8 *The specific-to-general 'see' reference in the thesaurus construction* and *The language of term designations in subject access vocabularies* soon to be published;

preparation and organization of an international Seminar on the UDC in Mechanized Retrieval System held in Copenhagen in September 1968.

Universal Decimal Classification

The Central Classification Committee (FID/CCC) has its secretariat at the FID General Secretariat, 7 Hofweg, The Hague. The Chairman of the Committee is Mr A. van der Laan, Director of the Nederlands Instituut voor Informatie, Documentatie en Registratuur (NIDER) in The Hague.

The Committee is responsible for the operation, supervision, revision and further development of the UDC.

The CCC members and experts come from Belgium, Brazil, Czechoslovakia, France, Germany, Hungary, Japan, Netherlands, Poland, Portugal, Spain, Sweden (also representing Finland), United Kingdom, USA, USSR and Yugoslavia.

This work is being done by the Committee itself and its nineteen UDC revision committees, each dealing with a separate field of science, technology, etc.

Particular attention is being paid to the relocation and major revision in the humanities and class O and a study is being made of relational indicators in the Universal Decimal Classification (UDC).

In the vast scope of its activities the CCC maintains close working contacts with a number of specialized international organizations.

The extensive publications programme of UDC editions includes:

sections of the Czechoslovak, English, German, Hungarian, Polish, Serbo-Croat, Spanish and other full editions;

the systematic part of the French medium edition and the alphabetical indexes of the English, Portuguese and Spanish medium editions;

the 2nd Finnish abridged edition, the 3rd and enlarged Japanese abridged edition, a condensed version of the Polish abridged edition;

special subject editions for hydrology (FID/WMO project), air/space science and technology (trilingual: Portuguese/English/German), electrical engineering (one in Danish, another in German), education (one in Portuguese, the other in Spanish) and for building and architecture (further issues in the ABC series).

An open UDC Forum was organized at the FID Conference in Moscow. Under the main theme, 'UDC as co-ordinating system in an international information network', there were four papers dealing with mechanization, application in geography and centralized classification of publications.

Linguistics in documentation

The Study Committee on Linguistics in Documentation (FID/LD), chaired by Professor W. N. Locke, Director of Libraries, Massachusetts Institute of Technology in Cambridge, Mass., has its secretariat at the Center for Applied Linguistics, 1717 Massachusetts Avenue, NW, Washington, DC 20036.

The Committee has members from Hungary, Israel, Japan, Netherlands, Poland, South Africa, Sweden, the Commonwealth Agricultural Bureaux and the European Communities.

The Committee is concerned with the study of linguistic problems involved in information systems. Being the newest of the FID committees, it has started its activities with a questionnaire to determine who are researchers throughout the world with interest and expertise in the area within the Committee's scope.

The Committee's work will include conceptual and operational linguistic problems involved in information systems and related lexicographical problems. It will treat linguistics in the creation, improvement and generalization of indexing and classification tools. It will also experiment with and evaluate linguistic techniques and solutions in documentation.

The Committee provides an international forum for discussion, co-ordination and international co-operation in this important area of information. Working with modern concepts of linguistics and information systems, it may stimulate research and development on a national level.

Machine techniques and systems

This area is covered by the following two Committees:

1. the Study Committee on the Theory of Machine Techniques and Systems (FID/TM), the Chairman of which is Dr K. Samuelson, Research Group of the Institutionen för Informationsbehandling (c/o Kungl. Tekniska Högskolans, Stockholm): the secretariat is at the Svenska Nationalkommittén för Dokumentation, c/o Kungl. Svenska Vetenskapskademien, Stockholm.

The Committee members represent Belgium, Poland, United Kingdom, USA, Commonwealth Agricultural Bureaux and Euratom.

A study group has been set up in Sweden to look into the problem of paperless communication and optimal information transfer in pictographic, written and spoken transmission.

Another problem studied by the Committee members is 'Concepts for systems design and synthesis'.

2. the Study Committee on Operational Machine Techniques and Systems (FID/OM), chaired by Mr M. Woitschach of IBM Deutschland, Postfach 266, 7032 Sindelfingen, Germany, with the secretariat at the same address.

Committee members have already been appointed by National Members in Germany, Hungary, Israel, Japan, South Africa, United Kingdom, USA and Yugoslavia.

The Committee programme for 1968 includes:

Standardization of information storage formats for mechanical retrieval on the basis of the UDC;

International exchange of information on the practical use of data processing systems in documentation;

Elaboration of methods to be used for transition from manual to mechanical documentation systems (a publication is envisaged).

Scientific and technical information for industry

The Study Committee on Information for Industry (FID/II), formerly called the Study Committee on Technical Information for Industry (FID/TI), is chaired by Mr R. E. McBurney, Chief of Technical Information Service, National Research Council, Sussex Drive, Ottawa 2, Ont., Canada. The Committee secretariat is at the same address.

The Committee has members from Belgium, Canada, Czechoslovakia, Denmark, Finland, Hungary, Israel, Japan, Netherlands, Norway, Poland, South Africa, Sweden, United Kingdom and USA.

A sub-committee on 'Effective means of communicating scientific and technical information to industry', formed 1963, has groups on Motivation of management, Dissemination, and Internal flow of information.

The Committee projects for 1968 include:

Publication of national lists of Technical Journals for Industry. These cover technical, scientific, economic and management journals of particular interest to industry, prepared in each country by the respective FID National Member. Such lists for Australia, Canada, Denmark, Finland, Hungary, Italy, Netherlands, Norway, Poland and South Africa have already appeared. Similar publications for some twenty more countries are in preparation;

Discussion of publication (possibly in 1969) of an International List of Technical Journals for Industry or an International Index to such journals;

Further study of effective means of communicating scientific and technical information to industry;

Exchange of data on the organization of information services and systems in member countries;

Discussion of publication (possibly in 1969) of the third edition of the *National technical information services—Worldwide directory* (previous edition published in 1966).

The Committee organized an international symposium on 'Information Needs of Industry', held in conjunction with the 34th FID Conference in Moscow.

Training of documentalists

The Study Committee for Training of Documentalists (FID/TD) has its secretariat at the Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej (CIINTE), Al. Niepodleglosci 188, Warsaw, Poland. The

Committee Chairman is Professor Z. Majewski of the Polish Committee for Science and Technology in Warsaw.

The following FID members have their representatives in the Committee: Belgium, Denmark, France, Germany, Hungary, Israel, Italy, Japan, Netherlands, Poland, Rumania, South Africa, Spain, Sweden, United Kingdom, USA, Yugoslavia and the Commonwealth Agricultural Bureaux.

The Committee programme includes:

Preparation of the second edition of the *Guide to the World's Training Facilities in Documentation and Information Work* for publication in 1969;

Preparation of a list of textbooks in the major world languages for training of documentalists.

Needs of developing countries

The Special Committee on Developing Countries (FID/DC), chaired by Dr P. Lázár, Director General of the Hungarian Central Technical Library and Documentation Centre (OMKDK), Reviczky u. 6, Budapest, has its secretariat at the same address.

The Committee has members from Belgium, Chile, Germany, Israel, Japan, Netherlands, Poland, Spain, Tunisia, United Kingdom, USA, USSR and the Commonwealth Agricultural Bureaux.

The Committee project includes:

Survey of the documentation activities and needs in developing countries;

Study of reprography for documentation needs in developing countries;

Preparation of a brochure on the role of documentation in developing countries;

Elaboration of proposals concerning documentation training in developing countries;

Preparation of a list of scientific and technical films.

Working Groups

In addition to the Committee, FID has two Working Groups:

Business Archives, with Mr A. van der Laan, Director of NIDER, Burgemeester van Karnebeeklaan 19, The Hague, as the Rapporteur. The secretariat is at the same address. A report on a job description of business archivists has been prepared for comment by experts.

Data Documentation, chaired by Dr H. Fink of Farbenfabriken Bayer Pharma, Leverkusen-Bayerwerk, Germany. The Group's work is at present limited to medical, chemical and social science data.

A special place in the programme activities of our Federation belongs to the FID Regional Commission for Latin America (FID/CLA), which consists at present of nine countries (Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Mexico, Uruguay and Venezuela).

Among the major projects carried out by FID/CLA I would like to mention the preparation and publication of a Guide to reprographic services in Latin America and a Directory of Latin American libraries and documentation centres.

Finally, a few words about the major projects undertaken by the FID General

Secretariat. The Classification Department, which serves also as the secretariat for the CCC, is engaged in implementing almost all of the CCC decisions. It regularly issues *P-Notes* (proposals for revision of the UDC) and *Extensions and Corrections to the UDC* (approved proposals for revision of the UDC). The Information Department issued at the end of last year *Directories of Science Information Sources. International bibliography* (lists 360 sources in fifty-three countries) and has recently issued the third edition of *Library and Documentation Journals* (lists 509 periodicals).

In conclusion allow me to express my hopes that this paper has shown you a vast scope of international activities of FID. For more details concerning the FID I would like to refer to the following publications: *1968 FID Yearbook*, *Report on the Activities of FID in 1967*, *Statement on a New FID Programme* and *1968 Catalogue of FID Publications*.

DISCUSSION

Mrs W. I. Veasy (Blackwell) asked whether there was any possibility of a Standard Periodical Number (SPN)? It seemed that the problems for an SPN would be greater than for the SBN.

Mr Holland replied that there would be problems and therefore present concentration is on SBN only with the SPN following later.

Mr K. J. Rider (Birmingham Science and Technology Library) made a plea for a Standard Report Number (SRN). Few would deny that the identification of individual papers was one of the most formidable daily problems in information work. The report numbering system used for United States government publications made the tracing of individual reports from these series a matter of routine. This numbering system was already used elsewhere and could well form the basis for the formulation of an international standard for the citation of papers and reports. Its effect on the avoidance of confusion in tracing papers would mean a tremendous saving of time and staff.

Mr Holland replied that the BSI Committee concerned with the presentation of technical reports would study this problem.

Mr S. C. Goddard (Kodak Limited, Harrow). Can anything be done to increase the observance of standards in documentation? There is still considerable variation in the requirements of the scientific and technical journals for papers submitted for publication. This is a constant source of difficulty among authors and editors who have to prepare material for a number of different periodicals.

Mr A. J. Dickson (Ealing Technical College) hoped that if the Dainton Committee resulted in national teaching libraries, lecturers in library schools would be more realistic in presenting classification problems and not dismiss enumerative classifications as unworthy of attention.

Mr F. Liebesny (British Aluminium Co. Ltd) pleaded that reliance on international co-operation should not only rest on organizations, but even more strongly on personal contacts and that Aslib members should seek more earnestly to establish such contacts.

Mr S. Francis (North-Western Polytechnic) said that one way to encourage international co-operation and to establish networks was to make more use of foreign visitors coming to this country. Could we not have a central source of information about such visits?

Mr Wilson (Aslib) replied that Aslib would be happy to make this information available if it had enough advance notice. There seemed to be no general solution to this problem.

Mr F. H. Ayres (Aldermaston Weapon Research Establishment) asked whether there was not a danger, when services were operated on an international basis, that the results would be neither sensible nor economic, partly for political reasons?

Dr Somerfield replied that this danger always existed. However, co-operation could always be developed by a series of bilateral arrangements.

Mr Wilson remarked that it was regrettable that the United Kingdom had not taken a larger part in the work of the FID. In general, we should ensure that the United Kingdom should play a greater part in the attendance and proceedings of international conferences. Many poorer countries sent larger delegations to these meetings. In general, bilateral arrangements should be explored further and we ought to play our part in testing and using foreign mechanized services. He also stressed that we have a real responsibility for helping developing countries.

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